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Connecticut Agricultural Experiment Station

New Haven, Connecticut

TWENTY-SIXTH REPORT

OF THE

STATE ENTOMOLOGIST

OF

CONNECTICUT

1926

W. E. BRITTON, Ph.D.
State Entomologist

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

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as of

February 1927

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AUTHORSHIP

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ILLUSTRATIONS

The illustrations in this Report (Bulletin 285) are from the following sources: Figs. 1, 3, 5, and 8, outline maps shaded by B. H. Walden; Fig. 7 drawn by J. P. Johnson; Fig. 10 drawn by R. C. Botsford; Fig. 2 after Federal Horticultural Board; Figs. 4, 6, 9, and 11, drawn by Dr. Philip Garman. Plates are all from photographs; XII, b and c, XIII, b and c, after U. S. Bureau of Entomology; XV, by R. C. Botsford; II, VII, a, XI, a, and XIV, b, by W. E. Britton; IV, by R. B. Friend; VIII, b, by J. P. Johnson; all others by B. H. Walden.

BULLETIN 285

TWENTY-SIXTH REPORT

OF THE

State Entomologist of Connecticut

To the Director and Board of Control of the Connecticut Agricultural Experiment Station:

I have the honor to transmit herewith my twenty-sixth annual report as State Entomologist of Connecticut. As usual, this report gives a full account of the activities of the Department of Entomology, particularly the inspection and control work prescribed by Statute, and also the various lines of research and observation dealing with economic insects, which have engaged the attention of the members of the Department staff during the year.

Respectfully submitted,

W. E. Britton,

State and Station Entomologist.

SUMMARY OF INSPECTION AND OFFICE WORK

230 samples of insects received for identification.
182 nurseries inspected.
174 regular certificates granted.
3 special raspberry certificates granted.
94 nursery dealers' permits issued.
181 shippers' permits issued to nurserymen in other states.
202 duplicate certificates furnished to be filed in other states.
121 parcels of nursery stock inspected and certified.
565 bales of mountain laurel and other decorative material inspected and certified for shipment.
25,000 narcissus bulbs inspected and certified.
45 orchards and gardens examined.
32 shipments, containing 347 cases, 3,443,357 plants, imported nursery stock inspected.
13 shipments, or 40.6 per cent, found infested with insects or fungi.
814 apiaries, containing 7,923 colonies. inspected.
26 apiaries and 68 colonies found infested with European foul brood.
14 apiaries and 23 colonies found infested with American foul brood.
3,143 letters written on official work.
915 circular letters.
418 post cards.
58 reports to Federal Horticultural Board.
3,262 bulletins, etc., mailed on request or to answer inquiries.
67 packages sent by mail and express.
26 lectures and addresses at institutes, granges, and other meetings.

PUBLICATIONS OF THE ENTOMOLOGICAL DEPARTMENT, 1926

By W. E. Britton:

Twenty-fifth Report of the State Entomologist of Connecticut (Bulletin 275), 120 pages, 13 figures, 20 plates; 10,500 copies distributed in April.

Inspection of Nurseries in 1925, 16 pages, 3 figures; reprinted from the Report; 300 copies, April.

A New Pest of Lawns, Bulletin of Immediate Information No. 52, December 15, 1925; 4 pages, 1 figure; 3,250 copies, sent in March to all families in region infested.

Asiatic Beetle Quarantine, Bulletin of Immediate Information No. 53, 2 pages; 1,500 copies, April.

Borers in Relation to Cavities in Trees, *Tree Talk*, Spring Number, 2½ pages, 2 figures, March.

Red Mite and Railroad Worm, Report of Thirty-second Annual Meeting of the Massachusetts Fruit Growers' Association, Inc., page 175, 6 pages, May, 1926.

Report of Committee on Injurious Insects, Proceedings of the Thirty-fifth Annual Meeting, Connecticut Pomological Society, page 38, 5 pages, April.

Insects Attacking Vegetable Crops in Connecticut in 1925, Report of Connecticut Vegetable Growers' Association for 1925, page 13, 7 pages, August.

Three Injurious Insects Recently Introduced into Connecticut, *Journal of Economic Entomology*, Vol. 19, page 540, 5 pages, June.

Some Insects and Entomologists, Fifty-sixth Annual Report of the Entomological Society of Ontario, page 55, 8½ pages, September.

The Gipsy Moth Quarantine, Bulletin of Immediate Information No. 54, 5 pages, 1 figure, 3,225 copies, October.

General Index to the Reports of the State Entomologist (Bulletin 281), 53 pages; 3,775 copies, October.

By W. E. Britton and G. P. Clinton:

Spray Bulletin (271), 50 pages, 104 figures, January.

By W. E. Britton and P. J. Anderson:

Tobacco Insects Observed in Connecticut in 1925 (Tobacco Station Bulletin 6), page 74, 20 pages, 16 figures, March.

By Philip Garman:

The Oriental Peach Moth Problem in Connecticut, Proceedings Thirty-fifth Annual Meeting, Connecticut Pomological Society, page 44, 3 pages, April.

By R. E. Andrew and Philip Garman:

A Chemical Investigation of Some Standard Spray Mixtures (Bulletin 278), 20 pages, July.

Effect of the Order of Mixing Various Spray Ingredients on the Formation of Injurious Compounds, *Journal of Economic Entomology*, Vol. 19, page 671, 1 page, August.

By R. C. Botsford:

Progress of Mosquito Control Work in Connecticut during the Past Year, Proceedings Thirteenth Annual Meeting, New Jersey Mosquito Extermination Association, page 85, 2 pages, 1926.

INSECT PEST ACCOUNT

Report of Receipts and Expenditures of the State Entomologist

From July 1, 1925, to June 30, 1926

Receipts

Insect Pest Appropriation (biennial)	$35,000.00
" " " additions (miscellaneous receipts)	40.18*
	$35,040.18

Expenditures

Salaries	$14,010.50	
Labor	3,711.30	
Stationery and Office Supplies	73.88	
Scientific apparatus (Chemicals)	35.54	
" " (Other laboratory supplies)	62.59	
" " (Photographic)	30.48	
Lumber and small hardware	8.55	
Miscellaneous supplies	203.64	
Fuel oil	1,700.47†	
Automobile oil	5.85	
Telegraph and Telephone	16.46	
Postage	74.55	
Travel (Outlying investigations)	437.90	
" (Meetings, Conferences, etc.)	166.49	
" (Gasoline for automobiles)	186.01	
Freight, Express and Parcel Post	53.44	
Furniture and Fixtures (New)	8.58	
" " " (Repairs)	....	
Library (Books and Periodicals)	38.23	
Scientific Equipment (New)	57.40	
Tools, Machinery and Appliances (New)	219.98	
" " " " (Repairs)	4.51	
Automobiles (Repairs)	390.83	
New Buildings and Structures	337.05	
Rent of Land	66.66	
Insurance (Automobile)	172.07	
Miscellaneous Contingent Expenses	35.15	
Total		$22,108.11
Balance		12,932.07
		$35,040.18

* Use of automobiles at 6 cents per mile $31.98
Sale of honey 8.20
$40.18

† For burning around European Corn Borer infestations.

DEPARTMENT STAFF AND WORK

W. E. Britton, Ph.D., *State and Station Entomologist.*
B. H. Walden, B.Agr., *Photographic and General Work* } *Assistant*
M. P. Zappe, B.S., *Inspection and General Work* } *Entomologists.*
Philip Garman, Ph.D., *Research Work*
Roger B. Friend, B.Sc., *Graduate Research Assistant.*
J. Peter Johnson, B.S., *Deputy in Charge of Asiatic Beetle Quarantine and Soil Treatment Work.*
John T. Ashworth, *Deputy in Charge of Gipsy Moth Work.*
James A. McEvoy, *Assistant in Gipsy Moth Work.*
Robert C. Botsford, *Deputy in Charge of Mosquito Work.*
Miss Gladys M. Finley, *Clerk and Stenographer.*[1]
Miss Grace A. Foote, B.A., *Secretary.*[2]
H. W. Coley, Westport } *Apiary Inspectors.*
A. W. Yates, Hartford }

Mr. Walden has continued to serve as chief photographer, has had charge of exhibits for the department, has been in charge of the office during the absence of the Entomologist, and has assisted in scoring fruit and in the general work of the department. He has also continued his researches on the imported currant worm, *Pteronidea ribesi* Scop.

Mr. Zappe has continued in charge of the inspection of nursery stock, and of the clean-up work around infestations of the European corn borer, in co-operation with the Federal Bureau of Entomology. He has collaborated with Dr. Garman in the study of the plum curculio in apple orchards, and with Mr. E. M. Stoddard of the Botany Department, in dusting and spraying experiments in apple orchards.

Dr. Garman has continued his researches on the Oriental peach moth, and in co-operation with Mr. Zappe has carried on the investigations of the plum curculio in apple orchards, on the five-year program begun in 1922. Dr. Garman has given much attention to the chemical changes taking place in combination spray mixtures, and in collaboration with Mr. R. E. Andrew of the Department of Analytical Chemistry, published the results as Bulletin 278, entitled, "A Chemical Investigation of Some Standard Spray Mixtures," issued in May, 1926. Dr. Garman has also given some attention to treatment for the American foul brood of bees, and observations on the European red mite and other species of mites, but his studies on the Oriental peach moth and the plum curculio have required most of his time. Dr. Garman has constantly revised and added to his manuscript on the Odonata or dragonflies of Connecticut, which will soon be published as a bulletin of the State Geological and Natural History Survey of Connecticut.

Mr. Friend has nearly completed his studies of the bionomics of

[1] Resigned May 1.
[2] Beginning May 1.

the birch leaf skeletonizer, and is now preparing it as his thesis for the degree of doctor of philosophy, and it will later be published as a Station bulletin. Mr. Friend has experimented in controlling the spruce gall aphid, and the results are published in this report. Mr. Friend was also in charge of the life-history investigations of the Asiatic beetle, and was assisted by Mr. Paul A. Davis, who was employed from April 6 to November 30 on this work. Mr. Friend has made some tests, at the Station farm at Mount Carmel, for the control of the cabbage maggot, squash vine borer, and several other insects attacking vegetable crops.

The gipsy moth work has been carried on efficiently as in former years under Deputy John T. Ashworth and his assistant, James A. McEvoy, with headquarters at Danielson. This work is done in co-operation with the Federal Bureau of Entomology.

Mr. Botsford has continued to serve as Deputy to Director Slate in charge of mosquito elimination work.

Mr. J. Peter Johnson, formerly connected with the Japanese beetle laboratory of the Bureau of Entomology, at Riverton, N. J., was employed, beginning April 12, in charge of quarantine enforcement and soil treatment on account of the Asiatic beetle. During the season for soil treatment, about 21 men were employed, these being largely high-school boys, as they were the most readily available form of help that could be obtained at short notice.

Mr. J. Leslie Rogers was employed in nursery inspection and as general assistant until the middle of September, when he entered college. Messrs. A. E. Warren, a graduate student in Yale University, and B. W. McFarland also helped inspect nurseries, as did Dr. W. R. Hunt of the Botany Department.

Messrs. A. W. Yates, Hartford, and H. W. Coley, Westport, have continued to inspect apiaries, as in former seasons, working on a *per diem* basis.

Miss Gladys M. Finley, who for seven years served very acceptably as clerk and stenographer, resigned May 1, and was married in September. Miss Grace A. Foote, who was employed in the department from 1915 to 1918, was appointed Secretary, beginning May 1.

All members of the staff have served faithfully, and to them in no small measure is due whatever degree of success has been reached in the work of the department during the year.

The Entomologist has directed the work of the department and attended to the office correspondence. He has continued to serve as Associate Editor of the *Journal of Economic Entomology*, as Insect Pest Reporter in Connecticut for the Insect Pest Survey of the Bureau of Entomology, and as Chairman of the Tree Protection Examining Board. Since October, 1925, he has also been Superintendent of the Geological and Natural History Survey of Connecticut.

The chief activities of the department are described in the following pages of this report.

INSECT COLLECTION

The Station collection of Connecticut insects is believed to be the most complete of any in existence and has been accumulated during the past twenty-five years. About 90 per cent. is Connecticut material. The following table shows the statistics based upon an inventory made in November, 1926:

STATISTICS OF INSECT COLLECTION

Order	No. of Conn. Species and Varieties	Extra Conn. Species and Varieties	Total	Type Material
Thysanura	9	..	9	
Isoptera	1	..	1	
Corrodentia	8	..	8	
Plecoptera	11	..	11	
Ephemerida	8	..	8	
Mallophaga	1	..	1	
Neuroptera	15	..	15	
Mecoptera	6	..	6	
Trichoptera	26	..	26	
Odonata	114	..	114	
Euplexoptera	2	..	2	
Orthoptera	100	3	103	
Thysanoptera	10	..	10	
Homoptera	474	24	498	1 type; 5 co-types
Heteroptera	324	50	374	20 Conn. paratypes; 25 ex-Conn.
Leidoptera	968	259	1,227	1 co-type
Siphonaptera	1	..	1	
Diptera	771	27	798	
Coleoptera	1,874	235	2,109	1 type
Hymenoptera	924	40	964	129 types; 12 paratypes
	5,647	638	6,285	131 types; 32 Conn. paratypes 6 co-types; 25 ex-Conn. paratypes

ENTOMOLOGICAL FEATURES OF 1926

The beginning of the season was cool, and all plant development was retarded. Nearly all kinds of insects were from one to three weeks later than usual in making their seasonal appearance. Low temperatures and scanty rainfall prevailed until after the middle of July. Consequently it was not a favorable season for early crops.

Fruit Insects

The notes and observations upon which this report is based were gathered from various sources. Some came from the members of the committee on injurious insects of the Connecticut Pomological Society, and others from correspondence, but the majority were gleaned by Messrs. Zappe and Stoddard on their visits to more than fifty orchards during the spring and summer.

The rosy apple aphid, *Anuraphis roseus* Baker, was less prevalent than usual in most orchards. Though present in many of them, real injury occurred in only a few localities. In the vicinity of Rockville some injury was observed on June 23, and at Ledyard, August 17, in one orchard there were many curled leaves and injured fruit clusters. A few aphids were noticed at Southington and Farmington April 28, Cheshire and Middlefield May 7, Milford May 17, Cannondale May 18, New Britain May 21, Thomaston and Washington May 24, Cornwall May 25, Branford and Guilford June 8, Wallingford and Southington June 16, Pomfret, Woodstock and Lebanon June 18, Niantic, Montville and Mystic June 18, and Hazardville June 23. In most places this pest was well controlled by natural enemies.

The green apple aphid, *Aphis pomi* De Geer, was very plentiful at Meriden, June 16.

The woolly apple aphid, *Eriosoma lanigerum* Hausm., was received on apple from West Haven, May 7, and West Hartford, October 20.

The apple red bug, *Lygidea mendax* Reut., was very scarce and no traces of it were observed in 33 orchards visited. Slight indications of its work were noticed at Milford, May 26, Southington, June 16, Woodstock, June 17, and Montville, June 18.

The grape phylloxera, *Phylloxera vitifoliae* Fitch, was received from New Britain, June 29.

The European red mite, *Paratetranychus pilosus* C. & F., caused some injury in orchards not receiving a dormant spray of miscible oil: there was little indication of its presence in orchards receiving such treatment. This pest was abundant at North Farms, Wallingford, May 14, Cheshire, May 17, Cannondale and Greenwich, May 18, New Britain, May 21, Thomaston, May 24, Milford, May 26, and Meriden, June 16. A few were noticed at Middlefield, May 7, Milford, May 17, Farmington and Newington, May 21, Litchfield and Torringford, May 24, Cornwall, May 25, North Farms, Wallingford, and Southington, June 16, and Montville, June 18. Specimens of eggs on apple were received from West Hartford, October 20.

Leafhoppers, *Empoa rosae* Linn., were unusually abundant in apple orchards, and caused some injury by spotting the leaves, and the excrement soiled the fruit late in the season. Though

apparently not present at all in some orchards, it was abundant at Milford, May 26, and was present at North Farms, Wallingford, May 14, Greenwich and Cannondale, May 18, Farmington, New Britain and Newington, May 21, Thomaston, Torringford and Washington, May 24, Cornwall and Bantam, May 25, Wallingford and Clintonville, June 2, Branford and Guilford, June 8, Meriden and Southington, June 16, Pomfret, Woodstock and Lebanon, June 17, Montville and Mystic, June 18, and Rockville, June 23. Mr. Drew thinks that leafhoppers were more abundant on trees treated with dust than on sprayed trees, but in the experiments of Zappe and Stoddard little difference could be detected.

The pear psylla, *Psylla pyricola* Forst., was rather more abundant than usual, particularly at Greenwich, at Mystic, June 18, and on one tree at Hazardville, June 23. Eggs and adults were present at Farmington, April 28, and a few nymphs were noticed at Newington, May 21. It was absent from the orchard visited at Washington, May 24.

The pear midge, *Contarinia pyrivora* Riley, was present and caused some injury at Meriden, June 16, where about 80 per cent of the fruit was infested.

Specimens of the pear leaf blister mite, *Eriophyes pyri* Nal., were received from Waterbury on May 25, and the pest was reported from Union by Mr. Tucker.

The sinuate pear borer, *Agrilus sinuatus* Oliv., has now spread eastward as far as New Haven, and two trees injured by the larvae were observed in September.

The Eastern tent caterpillar, *Malacosma americana* Fabr., was extremely abundant throughout the State, though from the history of former outbreaks we expected to see signs of subsidence. The caterpillars were numerous in orchards at Farmington, April 28, Middlefield, May 7, and Wallingford, June 2. Egg-masses were received at the Station from Wallingford, January 26, Milford, March 3, Branford, March 30, New Haven, July 15, and West Hartford, October 20.

The plum curculio, *Conotrachelus nenuphar* Hbst., was late in appearing but caused about the usual amount of damage, though perhaps better control was obtained by spraying than heretofore. No injury was reported from 27 orchards visited, but this insect or its work was observed at Wallingford, June 2, Branford, June 8, Southington, June 16, Pomfret and Lebanon, June 17, Niantic, Montville and Mystic, June 18, and Hazardville, June 23. Specimens of injury were received from New Haven, June 26, Norwalk, July 9 and November 15, Milford, November 17, and Danbury, November 24. Curculio grubs in almond were received from Stamford, July 11. These were probably plum curculio grubs, but the adults have not been reared.

The San José scale, *Aspidiotus perniciosus* Comstock, is not

troublesome in orchards receiving a dormant spray of lime-sulphur or miscible oils, but still causes some injury on untreated trees and shrubs. Specimens were received at the Station on apple from West Haven, May 7, New Haven, September 3, and Old Saybrook, December 2. The scurfy scale, *Chionaspis furfura* Fitch, was received from Guilford on apple, September 1. *Lecanium corni* Bouché was received from Seymour, March 29, on grape.

The apple maggot, *Rhagoletis pomonella* Walsh, was present as usual and infested fruit was noticed in many localities. Material was received from Saugatuck, October 13, Mystic, November 13, and Milford, November 17. Late spraying with lead arsenate with two applications in July, one just after July 4, and another soon after July 20, will usually control this pest. We have even made an application during the first week in August, but this is recommended only on the late-ripening varieties.

The fall canker worm, *Alsophila pometaria* Harris, was present as usual in certain localities, but perhaps caused less injury than in 1925. Slight injury was noticed in Greenwich, May 18, Milford, May 26, Wallingford, June 2, and Rockville, June 23.

There were complaints from Bolton of climbing cutworms eating grape buds and strawberry crowns, on May 17. Specimens submitted proved to be *Noctua unicolor* Walk. Also at Wallingford May 14, climbing cutworms ate the buds from young apple trees budded the preceding summer; adults were reared and proved to be *Feltia subgothica* Haworth.

At North Farms, Wallingford, May 14, a few specimens of the bud moth, *Tmetocera ocellana* Schiff., were noticed. The red-banded leaf-roller, *Eulia velutinana* Walk., was present in orchards as usual late in the season, though probably somewhat less than in 1925. On sprayed trees this injury was less than one-third that of the check or untreated trees. The apple leaf-crumpler, *Mineola indiginella* Zell., was more abundant than usual on unsprayed apples and quinces in New Haven and Hamden. Spraying with lead arsenate is the remedy for these leaf feeders.

The Oriental peach moth, *Laspeyresia molesta* Busck, was prevalent to about the same extent as in 1925, causing more injury in some orchards and less in others. The average infestation of the fruit of late varieties was probably not much above 10 per cent. No good control measures have yet been found.

The apple and thorn skeletonizer, *Hemerophila pariana* Clerck, which in 1923 caused all unsprayed apple trees to become brown in July, caused no noticeable injury in 1926, though traces of it could be found nearly everywhere.

Injury to twigs through the oviposition of tree crickets was received on apple from Collinsville, June 3, and on cherry from Mystic, October 30. *Œcanthus nigricornis* Walker is the species

responsible. Twigs are apt to break off at the point where the eggs are laid.

Specimens of the spotted grape-vine beetle, *Pelidnota punctata* Linn., were received from Woodbridge, August 5, where they were feeding upon grape foliage.

The larva of the leopard moth, *Zeuzera pyrina* Linn., tunneling in the wood of a young apple tree was received from Danbury, August 12.

The rose chafer, *Macrodactylus subspinosus* Fabr., was less abundant than usual, and nearly a week later in appearing. The first beetle was noticed in New Haven on June 17.

The codling moth, *Carpocapsa pomonella* Linn., was somewhat less abundant than usual.

Insects Attacking Vegetable Crops

For many of the notes and observations regarding vegetable insects I am indebted to Mr. A. E. Wilkinson, vegetable specialist of the Extension Department, Connecticut Agricultural College, Storrs.

Injury by cutworms was serious during the month of May, and reports were received from all eight counties in the State. The first report came from New Haven County on May 1, and on May 12 one Westville grower reported that he had lost 5,000 out of 6,000 tomato plants. It is certain that vegetable growers could greatly reduce their losses if they would each year distribute poisoned bran mash in their fields a few days before setting their plants, or in case of seeding in the field, before much injury has occurred.

Mr. Wilkinson reported injury by wireworms at Mount Carmel, May 1, and to potatoes at Vernon in September.

The pea aphid, *Illinoia pisi* (Kalt.), was prevalent and caused great damage in June in many sections of the State. Mr. Wilkinson observed it at Southington, Plainville, Glastonbury, Wethersfield, Windsor and East Granby, June 22; he found it very abundant in New Haven County June 26, and a heavy infestation throughout Fairfield and Litchfield Counties, July 10. In my own garden, some late-planted peas, when about four inches tall, were noticed to be heavily infested. I killed nearly all the aphids by directing a spray of nicotine downward upon the plants but the growth of the plants had already been checked and a very light crop resulted.

The imported cabbage worm, *Pieris rapae* Linn., was about as abundant as usual, particularly late in the season. Mr. Wilkinson reported few at Danbury and Stratford, June 5, but found them abundant everywhere September 25.

The cabbage looper, *Autographa brassicae* Riley, was everywhere abundant in September. The larvae eat holes into the center of the heads.

The cabbage aphid, *Brevicoryne brassicae* Linn., was not very injurious but was reported by Mr. Wilkinson as being present in a field of 56,000 plants at Northfield, July 10. At the Station farm, Mount Carmel, the insect was noticed, but it caused no injury.

The cabbage maggot, *Hylemyia brassicae* Bouché, caused about the usual amount of damage, and was reported from Danbury, June 5, Wethersfield, June 22, and New Haven County, June 26. It was present in abundance at the Station farm at Mount Carmel, where Mr. Friend carried on his experiments. So far he has not found any method of control that gives better results than treating the plants with corrosive sublimate, one ounce in ten gallons of water.

The diamond-back moth, *Plutella maculipennis* Curtis, was more prominent than usual. The first specimens that came to my attention were on a head of cabbage brought from Southington by Mr. Wilkinson and given to me at the annual Field Day at the Station farm, July 28. Mr. Wilkinson also reported this pest as being present on cabbage and cauliflower at Cheshire, Wapping and Taftville on September 25. It was also present at the Station farm at Mount Carmel. This is a European pest, and there are two or three generations each year in the northern states. In Colorado there are seven broods and in the South breeding is almost continuous. The larvae eat holes on the under side of the leaves. They do not eat entirely through but leave the upper epidermis. The holes show as transparent spots when held to the light. Heavily spraying the under surface of the leaves with lead arsenate is the remedy. Possibly dusting with powdered lead arsenate may control this pest but I have not had an opportunity to try it.

The striped cucumber beetle, *Diabrotica vittata* Fabr., was reported as being less common than usual at East Hartford, Glastonbury, and Plainville, June 22. In my own garden at Mount Carmel where squashes were grown the year before, there were no beetles until late in June when the plants were about six inches high; then the beetles came upon them in great numbers and bid fair to ruin the plants. On June 28, the plants were dusted with calcium fluosilicate, which cleaned out the beetles without injuring the plants. Some of the plants, however, were injured by the grubs tunneling in the main root; this was followed by wilt and the vines died.

The squash bug, *Anasa tristis* De Geer, was very abundant at Mount Carmel late in July. It was reported from Vernon,

Ellington, Woodstock, Brooklyn, Canterbury and Ledyard on July 17. The young bugs can be killed by a spray of 40 per cent nicotine solution, 1 part in 150 parts of water.

The squash lady beetle, *Epilachna borealis* Fabr., was reported from Ledyard July 17, by Mr. Wilkinson. I also observed it in a garden in Ledyard, August 17. Both larvae and adults were present. The larvae are yellow, with black spines on the back. They have the habit of marking out on the upper side of a leaf a circular or oval area half or three-fourths of an inch in diameter, and then eating off the green tissue within the area outlined. Spraying with lead arsenate is a remedy.

The squash borer, *Melittia satyriniformis* Hubn., continues to be a serious pest and was apparently more abundant than usual in 1926. In normal seasons, nearly all eggs have been laid by August 1, but the past season the adults were present on the vines during the first half of August and I found one moth at Ledyard on August 17. As a rule early-planted summer crook-necks will produce a crop before the squash borer attacks them. Experiments at the Massachusetts Station a few years ago showed that by spraying the bases of the vines once a week during July with 40 per cent nicotine sulphate solution, one part in 150 parts of water, the eggs will be killed. In Mr. Friend's experiments at the Station farm at Mount Carmel, he found that many eggs were laid on the vines at points from four to ten feet from the base or beyond the portion covered by the spray. It is very difficult to spray all parts of a vine after it has begun to run. Even with such a spray treatment it is advisable to cut out the borers, and to cover each vine with soil, thus enabling it to make new roots.

The potato flea beetle, *Epitrix cucumeris* Harris, was common nearly everywhere. Mr. Wilkinson reported it on lettuce and carrots at Mount Carmel May 1; on tomatoes and egg-plants at North Haven, New Haven, Hamden, Branford and Milford, May 29; on tomatoes at Stratford, Westport, Danbury, Bethel and Thomaston, June 5; on cucumber at East Hartford, Glastonbury and Plainville, and on potatoes and tomatoes at Glastonbury, June 22. This is a hard pest to control but on a few plants in the home garden I have freed the plants by spraying them with nicotine sulphate solution.

Asparagus beetles were present in about the usual numbers. The common asparagus beetle, *Crioceris asparagi* Linn., is the one which is responsible for most of the injury to foliage and new shoots. The spotted asparagus beetle, *Crioceris 12-punctata* Linn., causes some injury by the adult beetles feeding on the new shoots and foliage, but the grubs feed chiefly on the seeds in the berries. Mr. Wilkinson reported the 12-spotted beetle more common than the other in New Haven County June 26, and also found it present at Groton, Pawcatuck, Norwich, Canterbury,

Wauregan and Danielson on July 17. He also reported the common asparagus beetle from Hamden, North Haven, Cheshire and Branford, May 29; Southington, Plainville, Bristol, Wethersfield, Windsor, Windsor Locks, East Granby, East Hartford, South Windsor and Storrs, June 22; and from Groton, Pawcatuck, Norwich, Canterbury, Wauregan and Danielson, July 17. Larvae and eggs were received from Ridgefield, June 22. As a rule clean cutting over the field as long as the cutting season lasts is a good practice, though some growers leave a few trap plants around the margins, to be destroyed later. After the cutting season ends, and on new beds, the foliage can be heavily sprayed with lead arsenate, with a casein spreader to kill both adults and larvae. The latter may be killed in the home garden by spraying with nicotine solution.

The horse-radish flea beetle, *Phyllotreta armoraciae* Koch, was reported from East Hartford, Wethersfield, and Storrs, June 22.

The black blister beetle, *Epicauta pennsylvanica* (De Geer), was received at the Station, July 27, feeding on Swiss chard, and the margined blister beetle, *Epicauta marginata* Fabr., from Wethersfield, July 28, feeding upon tomato.

The corn ear worm, *Heliothis obsoleta* Fabr., was apparently less troublesome than usual, and the only specimens received at the Station came from New Britain, October 9, on sweet corn.

The parsley stalk-weevil, *Listronotus latiusculus* Boh., was received from New Haven, July 15.

The stalk borer, *Papaipema nitela* Guen., was present and caused the usual amount of injury in all kinds of herbaceous plants. One specimen in corn was received at the Station from New Haven, July 22. Its work was observed in many places.

Shade and Forest Tree Insects

Two of the most important features concerning shade tree insects are the discovery of the satin moth in the State and the prevalence of the birch leaf miner. The satin moth, *Stilpnotia salicis* Linn., has now invaded Connecticut, and one egg-mass was found in Thompson and another in Stonington by Federal men, and these two towns are now under Federal quarantine on account of this insect. No poplar or willow trees may be moved interstate from these towns without a Federal inspection and certificate.

The birch leaf miner, *Fenusa pumila* Klug, has now spread throughout southern New England and southeastern New York, and is beginning to attract considerable attention. Specimens have been received at the Station from Fairfield, June 15, Norwalk, June 18, East Haven, June 24, Hartford, July 28 and August 30, Westport, August 11, Waterford, August 13, and Danbury, August 19.

The elm sawfly leaf miner, *Kaliofenusa ulmi* Sund., continues to attack elm trees in the northwestern portion of the State. Specimens were received from Norfolk on June 30.

The imported pine sawfly, *Diprion simile* Hart., occurs here and there on white pine but causes little damage. Specimens were received from New Haven, July 21 and September 29. An allied species, *Neodiprion lecontei* Fitch, was received from Danbury, September 10. This species attacks pitch pines and other three-leaved species. Spraying with lead arsenate will protect the trees from being devoured by sawfly larvae.

The fall webworm, *Hyphantria cunea* Drury, was observed in late summer on fruit, shade, and forest trees in all parts of the State. It was seemingly more abundant than usual, particularly in Fairfield and Hartford Counties.

The European pine shoot moth, *Rhyacionia buoliana* Schiff., was received on red pine from Greenwich, April 9, and on Scotch pine from Southport, June 17.

The walnut caterpillar, *Datana integerrima* S. & A., was present as usual, and specimens were received from Saybrook, August 24, and from Collinsville, September 8.

The spruce bud worm, *Harmaloga fumiferana* Clem., is responsible for occasional damage to spruce trees in Connecticut, and specimens were received from West Haven, June 14.

The white-marked tussock moth, *Hemerocampa leucostigma* S. & A., attacks fruit, shade, and forest trees, and specimens were received from Middletown, April 27, and from Granby, June 16.

The pine tube moth, *Eulia pinatubana* Kearf., occasionally causes partial defoliation of white pine trees, and specimens were received from New Haven, October 5. Spraying with lead arsenate is the remedy.

The blotch leaf miner of white oak, *Lithocolletis hamadryadella* Clem., frequently injures and disfigures white oak trees by mining the leaves. No remedy can be advised. Specimens were received from Hartford, July 30.

The pine leaf scale, *Chionaspis pinifoliae* Fitch, continues to be a rather important pest on various species of pines in ornamental plantings, particularly in sheltered situations. Specimens were received on Scotch pine from Hartford, April 5, from New Haven, April 19, and from Watertown, May 17.

The spruce gall aphid, *Adelges abietis* Linn., commonly disfigures Norway and other spruce trees in Connecticut, and in nurseries and ornamental plantings spraying must now be practiced to prevent the formation of galls. Specimens were received from Bolton, February 5, New Preston June 14, Middlebury, July 15, Middletown, August 18, Norwich, September 15, and Forestville, October 4. Experiments in controlling this pest were

conducted by Mr. Friend of this Department, and are described on page 223 of this Report.

The gall aphid of the blue spruce, *Gillettea cooleyi* Gillette, forms terminal galls larger than the preceding. A variety of *cooleyi* (var. *coweni* Gillette) appears as a woolly aphid on Douglas fir, and specimens were received from Cheshire, July 5.

The spiny aphid gall of witch hazel, *Hamamelistes spinosus* Shimer, was received from Naugatuck, October 5.

A woolly aphid on maple, *Neoprociphilus aceris* Mon., was received from Winsted, July 22.

A gall-forming aphid, *Colopha ulmicola* Fitch, was received from New Britain, on elm, July 8.

The oyster-shell scale, *Lepidosaphes ulmi* Linn., is one of the most common scale insects in Connecticut and attacks a large number of different kinds of trees and shrubs. This insect was received on box from New London, February 24, and on *Juglans* from Plantsville, June 8.

The oak-gall scale, probably *Kermes pubescens* Bogue, was received on oak from Norwalk, August 16.

The tulip tree scale, *Toumeyella liriodendri* Gmel., is rather common on tulip trees, and a specimen was received from Middletown, August 2, and from New London, December 20.

The cottony maple scale, *Pulvinaria vitis* Linn., which has been quite common on silver maples around Stamford for the past few years, was received from Westport, August 11, and from New Haven, July 21.

Specimens of a Japanese scale, *Leucaspis japonica* Cockerell, were received from Greenwich, December 14, on maple.

The oak twig pruner, *Hypermallus villosus* Fabr., is responsible for the cutting of small twigs of oak and some other trees, and these twigs fall upon the lawn, making more or less litter. The insect usually falls in the stem of the severed twig, and gathering and burning the twigs promptly is one method of control. Specimens were received from Greenwich, August 16.

The maple borer, *Glycobius* (*Plagionotus*) *speciosus* Say, is present each year in Connecticut and causes much injury to sugar maple trees, whether cultivated or growing wild. A specimen of the adult beetle was received from New Haven, July 15.

The locust leaf miner, *Chalepus* (*Odontota*) *dorsalis* Thunb., was received from Danbury, August 19. The larvae mine the leaves, which turn brown in July and August.

Specimens of red pine were received from Clark's Corners, July 21, the leaders of which had been eaten in a peculiar manner. Though no insect could be found on the specimen twigs, it appeared to be the work of insects, and the pales weevil, *Hylobius pales* Boh., is suspected of having caused the injury.

The elm leaf beetle, *Galerucella xanthomelaena* Schrank (*luteola* Müll.), was moderately abundant throughout the southern portion of the State, and in many towns and cities the trees were sprayed with lead arsenate to prevent defoliation.

The following dipterous galls on shade trees have been sent to the Station during the season: the ash midrib gall, *Contarinia canadensis* Felt, on leaves of white ash, Ridgefield, June 16; maple leaf spot, *Cecidomyia ocellaris* O. S., on leaves of red maple, Ridgefield, June 16; linden wart gall, *Cecidomyia verrucicola* O. S., on leaves of linden, Guilford, July 15; oak spangles, *Cecidomyia poculum* O. S., on leaves of white oak, Danbury, August 19, Guilford, September 14, and Salisbury, September 20.

Mites often cause injury to shade trees, and one species, *Schizotetranychus schizopus* Zacher, was received from Old Lyme, May 10, on willow. The maple bladder gall, *Phyllocoptes quadripes* Shimer, is common on the leaves of silver maple, and specimens were received from Woodmont, June 11, Greenwich, July 22, Waterford, August 13, and Fairfield, August 24.

Insects Attacking Ornamental Shrubs and Plants

The mealy flatas, *Ormenis pruinosa* Say, and *septentrionalis* Spin., are often found on woody vines and shrubs, and sometimes on herbaceous stems. An outbreak of *O. pruinosa* in Bridgeport on Ibota privet is described elsewhere in this Report. Specimens of both species were received from Bridgeport, August 3, and of *O. septentrionalis* from Hartford, September 8.

The white peach scale, formerly known as the West Indian peach scale, *Aulacaspis pentagona* Targ.-Tozz., was received from Stamford, on lilac, December 14.

The euonymus scale, *Chionaspis euonymi* Comst., which causes serious injury to certain species of Euonymus, was received from Norwalk, November 15.

The rhododendron lace bug, *Leptobyrsa rhododendri* Horv., which sucks the sap from the under surface of the leaves of certain species and varieties of rhododendron, was received from New Haven, May 3, and from Stamford, September 3. The remedy is to spray with nicotine solution and soap, directing the spray against the immature bugs on the lower side of the leaves.

Larvae of the iris borer, *Macronoctua onusta* Grote, were received from Guilford, July 15, and from Old Saybrook, August 7. As the eggs are laid on iris leaves in October, gathering and burning the leaves in spring is a means of control.

Specimens of the juniper webworm, *Dichomeris marginellus* Fabr., were received from New Haven, July 15. Spraying with lead arsenate is the remedy.

The garden millipede, *Julus hortensis* Wood, was received from

Hartford, June 23, where tulip bulbs had been injured and many immature millipedes were present.

The cyclamen mite, *Tarsonemus pallidus* Banks, now causes injury to several kinds of plants, particularly cyclamen, chrysanthemum, delphinium and snapdragon, causing the young leaves to become swollen and distorted. Specimens were received on delphinium from Danbury, June 1, New Haven, June 8, and on snapdragon from West Hartford, June 11. One remedy is to spray with nicotine solution and soap.

The bulb mite, *Rhizoglyphus hyacinthi* Banks, was received in tulip bulbs from Hartford, June 3.

Household Insects

The black carpet beetle, *Attagenus piceus* Oliv., was received from New Britain, June 25. The larvae are found in the cracks of floors, where they feed upon lint and small particles of animal or vegetable matter. The adult beetles, as well as the larvae, often eat holes in clothing in closets. One method of preventing injury to clothing is to place woollen rags on the floor and walls of the closet, as these rags will often be eaten instead of the clothes.

The spotted silver fish, *Thermobia domestica* Pack, was received from New Haven, October 9. This insect, like its close relative, lives in houses where it hides away in cracks of the woodwork and feeds upon the paste of books, often greatly disfiguring them.

The dog flea, *Ctenocephalus canis* Curtis, was received from South Meriden, August 5.

Specimens of cracked corn were brought to the laboratory from New Haven on February 24, upon which were feeding three kinds of small beetles commonly attacking stored grains. These were the rice weevil, *Calendra oryzae* Linn., the saw-toothed grain beetle, *Silvanus surinamensis* Linn., and *Laemophlaeus pusillus* Schr.

Insects Attacking Field Crops

The Eastern field wireworm, *Limonus agonus* Say, which caused much injury in tobacco fields in 1925, was present in the same fields in 1926, although the injury was less. One grower tried the method practiced in California, namely, of planting every fourth or fifth row with corn as a trap crop. When most of the wireworms had been attracted to the corn, Cyanogas or calcium cyanide compound was drilled in along the rows at the rate of about 100 pounds per acre. This, of course, killed the corn and nearly all of the wireworms. The tobacco plants were then set and were not injured. This system can be employed by the vegetable grower.

In 1925, the European corn borer, *Pyrausta nubilalis* Hubn.,

was found in twenty separate fields and gardens in the five towns of Bridgeport, Saybrook, New London, Groton, and Stonington. Clean-up work was done around each infestation in late fall and spring. The entire region was again scouted in 1926 and no signs of the pest found at Bridgeport and Saybrook, but one infestation was found at Woodmont in the town of Milford, and several were found in East Lyme, Waterford, New London, Groton and Stonington. These five towns in New London County will soon be placed under Federal quarantine.[1] No other part of the state has as yet become generally infested, and we aim to prevent this as far as possible, particularly on account of the important seed-corn interests of the state. But our control work depends somewhat on the size of our appropriations, and probably the time will soon come when it cannot entirely be held back, even with large appropriations.

Much progress has been made during the year in a study of the life history, habits, and methods of control of the Asiatic beetle, *Anomala orientalis* Waterhouse, mentioned in my last report, the grubs of which feed upon the roots of grass in lawns in the western part of the city of New Haven. It is found that the beetles fly somewhat and feed slightly in the flowers of roses, hollyhocks, etc. Some 43 acres of lawns and gardens in New Haven were treated with a specially prepared emulsion of carbon disulphide. The area has been placed under quarantine in order to prevent, so far as possible, the spread of the insect through artificial means.

The Japanese beetle, *Popillia japonica* Newman, which has been such a nuisance on fruit, flower and vegetable crops in New Jersey, Pennsylvania, and northern Delaware, has now spread northward, infesting the western end of Long Island and Westchester County in New York, and in late summer a few of the beetles were found in Stamford, Conn. As Port Chester, N. Y., is also infested, it was necessary to include Greenwich with Stamford in the Federal quarantine, and both towns have since been placed under State quarantine. Though control measures may retard the natural spread of this insect, I doubt if it is humanly possible to prevent it from infesting the entire State within a few years if it continues to spread at the same rate that it has since it was discovered in this country ten years ago. The beetles feed upon the foliage, flowers, and fruit of many kinds of trees and plants, including fruit trees, roses, sweet corn, beans, etc. In the region around Philadelphia, not only must the vegetables be inspected and certified before shipment, but some of them must be given special packages and stored under screens, and during

[1] A Federal quarantine, effective March 1, 1927, has been placed on the towns of East Lyme, Waterford, New London, Groton and Stonington.

the period when the beetles fly about in swarms, vegetable shipments are stopped entirely for a few days.

The Colorado potato beetle, *Leptinotarsa decemlineata* Say, was rather less abundant than usual throughout the State.

White grubs, *Phyllophaga* sp., were reported as injuring potatoes at Vernon in September.

Miscellaneous Insects

Specimens of the American cockroach, *Periplaneta americana* Linn., were brought to the Station on August 5, from a dump along the Boulevard, New Haven, where they were present in large numbers; also from a factory restaurant in New Haven, October 4.

The large garden slug, *Limax maximus* Linn., was received from New Haven, June 14. This slug often does considerable damage by feeding upon the leaves of vegetable and flowering plants in gardens, and leaves a slimy trail wherever it crawls. These animals feed chiefly at night and hide away during the daytime. When found, they can easily be destroyed by shaking a little table salt upon them. Foliage which is not for food may be sprayed with lead arsenate, and food plants may be protected by surrounding them with a barrier of air-slaked lime or fine coal or wood ashes.

General Index to Reports

A general index to the first twenty-five reports of the State Entomologist of Connecticut has been prepared and published as Bulletin 281 of this Station. Though each Report has its own index, for ready reference this general index is of great assistance, as it saves consulting the indices of the separate Reports. There are now many scientific and public libraries, and individuals, particularly entomologists, that bind these Reports together, and wherever such plans are contemplated, the general index should be secured and made a part of the set. It also contains a list of errata and an index to all text figures and plates which have appeared in the twenty-five Reports.

Convention of Entomological Workers

The third convention of Entomologists working in Connecticut was held at the Connecticut Agricultural College, Storrs, October 29, 1926. The program was similar to that of last year and, besides containing papers of Connecticut entomologists and those of Federal men working co-operatively within the State, included also papers by Dr. E. P. Felt, State Entomologist, Albany, N. Y.,

and Professor A. I. Bourne, Agricultural Experiment Station, Amherst, Mass., on subjects of much interest to Connecticut workers. The meeting was held in the pleasant assembly room of the new Community House, and an excellent luncheon was served in the College dining hall. About 54 attended this meeting. Mr. Loren B. Smith was unable to be present, and his place was filled very acceptably by Mr. E. Avery Richmond. The program was as follows:

PROGRAM

A. M.

10:00 Greetings.
C. L. Beach, President, Connecticut Agricultural College, Storrs, Conn.

10:15 The Training of Entomological Investigators.
Prof. G. H. Lamson, Jr., Connecticut Agricultural College, Storrs, Conn.

10:30 Summary of Six Years' Experiments in Orchard Dusting and Spraying.
M. P. Zappe, Connecticut Agricultural Experiment Station, New Haven, Conn.

11:00 Some Insect Pests Which Have Recently Appeared in Connecticut.
W. E. Britton, State Entomologist, New Haven, Conn.

11:15 The Occurrence of *Autoserica japonica* in the United States.
E. P. Felt, State Entomologist, Albany, N. Y.

11:30 Present Status of the European Corn Borer in the United States.
L. H. Worthley, In Charge of Federal Control Work, Arlington, Mass.

12:00 Recent Developments in the Control of the Japanese Beetle.
Loren B. Smith, In Charge of Federal Work, Riverton, N. J.

P. M.

1:00 Luncheon.

2:00 Present Status of the Gipsy Moth, Brown-tail Moth and Satin Moth.
A. F. Burgess, In Charge of Federal Moth Work, Melrose Highlands, Mass.

2:45 Recent Observations on the Codling Moth in Massachusetts.
A. I. Bourne, Agricultural Experiment Station, Amherst, Mass.

3:00 Habits and Life History of the Asiatic Beetle, *Anomala orientalis*.
R. B. Friend, Agricultural Experiment Station, New Haven, Conn.

3:30 Soil Treatment and Scouting for the Control of the Asiatic Beetle.
J. Peter Johnson, Agricultural Experiment Station, New Haven, Conn.

4:00 Work of the Season with the Oriental Peach Moth.
Philip Garman, Agricultural Experiment Station, New Haven, Conn.

4:30 Recent Studies on the Bean Weevil.
J. A. Manter, Agricultural College, Storrs, Conn.

The following were present: William J. Ahearn, Westerly, R. I.; John T. Ashworth, Danielson, Conn.; Ellery Atwood, Thomaston, Conn.; C. L. Beach, Storrs, Conn.; H. L. Blaisdell, Melrose Highlands, Mass.; A. I. Bourne, Amherst, Mass.; W. E. Britton, New Haven, Conn.; A. F. Burgess, Melrose Highlands, Mass.; C. A. Clark, Greenwich, Conn.; G. M. Codding, Mount Vernon, N. Y.; C. W. Collins, Melrose Highlands, Mass.; W. A. Collins, New Milford, Conn.; O. B. Cook, Danielson, Conn.;

H. E. Cooke, Danielson, Conn.; R. G. Cooper, Colebrook, Conn.; S. S. Crossman, Melrose Highlands, Mass.; P. A. Davis, New Haven, Conn.; William W. Eells, Manchester, Conn.; C. M. Emerson, Hartford, Conn.; E. P. Felt, Albany, N. Y.; R. B. Friend, New Haven, Conn.; C. W. Frink, Brooklyn, Conn.; Philip Garman, New Haven, Conn; A. J. Gilbert, Jewett City, Conn.; S. P. Hollister, Storrs, Conn.; H. C. Huckett, Riverhead, N. Y.; J. Peter Johnson, New Haven, Conn.; John F. Keough, Willimantic, Conn.; Dolor La Belle, Ballouville, Conn.; G. H. Lamson, Jr., Storrs, Conn.; A. J. Lannon, Providence, R. I.; Allen Latham, Norwichtown, Conn.; J. W. Longo, Danielson, Conn.; Edwin T. Lundberg, Greenwich, Conn.; J. A. Manter, Storrs, Conn.; W. E. Mattson, Colebrook, Conn.; S. E. May, Canaan, Conn.; J. A. McEvoy, Putnam, Conn.; B. W. McFarland, New Haven, Conn.; H. L. McIntyre, Albany, N. Y.; W. B. Mix, Stamford, Conn.; R. C. Newton, Storrs, Conn.; W. J. Powers, Boston, Mass.; F. C. Rich, Ansonia, Conn.; E. Avery Richmond, Riverton, N. J.; J. B. Riley, Killingly, Conn.; W. L. Slate, Jr., New Haven, Conn.; R. A. Spencer, Hartford, Conn.; O. W. Spicer, Stamford, Conn.; A. E. Stene, Kingston, R. I.; B. H. Walden, New Haven, Conn.; J. R. Ward, New London, Conn.; L. H. Worthley, Boston, Mass.; M. P. Zappe, New Haven, Conn.

INSPECTION OF NURSERIES IN 1926

W. E. Britton and M. P. Zappe

The annual inspection of growing nursery stock was commenced July 6 and finished in September except for a few scattered nurseries, the final inspection being made November 16. This work was in charge of Mr. Zappe, who was assisted by J. L. Rogers, A. E. Warren, and Dr. W. R. Hunt. Assistance in a few nurseries was rendered by B. W. McFarland, A. D. McDonnell, B. H. Walden, E. M. Stoddard, J. E. Riley, J. T. Ashworth, R. C. Botsford, and W. E. Britton.

Dr. Hunt of the Botany Department was assigned to this work in order to give special attention to plant diseases which might be found in the nursery, and on certain days when he could not be present, Mr. A. D. McDonnell was detailed to go in his place.

In addition to the inspections made by the nursery inspectors, the gipsy moth scouts were instructed to make careful examinations for gipsy moth eggs in and around all nurseries in the quarantined area, and to report to the office in case any were found. No gipsy moth infestations were discovered in or near any Connecticut nursery in 1926.

In 46 nurseries no important pests were found. A list of insects and plant diseases found in nurseries during the annual inspection of 1926, together with the number of nurseries infested by each, is given below:

Pests Found in Nurseries in 1926

Nurseries uninfested	46

INSECTS

Name	No. Nurseries
Aphids, apple, green	43
woolly	35
on caragana	1
catalpa	1
cherry	1
currant	1
spiraea van Houtei	1
viburnum	1
willows	2
Spruce gall *Chermes abietis*	35
" *cooleyi*	7
Larch *Chermes*	5
Pine bark *Chermes*	7
Apple and thorn skeletonizer	19
Birch leaf miner	20
Borer in apple	1
ash	1
Mugho pine	1
lilac	2
maple	1
peach	1
poplar	1
red pine shoots	1
rose	1
willow	2
Cecropia caterpillar	1
Cherry and pear slug	17
Curculio, walnut	1
Elm leaf beetle	4
Fall webworm	11
Lace bugs on linden	1
quince	1
oak	1
rhododendron	23
sycamore	1
Janus abbreviatus	2
Juniper webworm	2
Leafhoppers on apple	35
grape	1
pear	1
rose	1
Leaf miners in *Catalpa bungei*	9
magnolia	1
maple	1
peach	2
tulip tree	1
Maple worm, green-striped	1
Mite, European red	5
pear blister	20
spruce	2
on *Amelanchier*	1
birch	1
cedar	1
silver maple	2
willow	1
Oriental peach moth	14
Pear psylla	7
Poplar flea beetle *Crepidodera helxines*	2
leaf beetle *Lina scripta*	6
Red-humped caterpillar	7
Rose chafer	2
stem girdler	1
Sawfly *Diprion simile*	1
on birch	1
currant	2
plum	1
white pine	1
Scale, elm	14
euonymus	2
Lecanium on oak	1
Leucaspis on lilac	1
oak gall	5
oyster-shell	39
pine leaf	5
rose	10
San José	19
scurfy	2
tulip tree	1
white peach on *Catalpa bungei*	1
Spiny elm caterpillar	1
Tarnished plant bug	1
Tent caterpillar	10
Thecodiplosis liriodendri	2
White-marked tussock moth	1
White pine weevil	8
Willow leaf beetle *Plagiodera versicolora*	6
galls	2
Yellow-necked caterpillar	2

PLANT DISEASES

Name	No. Nurseries
Anthracnose on currant	1
Apple scab	38
Black knot	3
rot on apple	26
cherry	1
Blight on horsechestnut	1
Brown rot	5
Canker, poplar	32
on willow	1
Chestnut blight	1

Name	No. Nurseries	Name	No. Nurseries
Crown gall	2	Mildew on phlox	3
Leaf spot on catalpa	21	rose	40
cherry	8	*Symphoricarpus*	1
linden	1	walnut	1
maple	2	Peach yellows	1
quince	7	Raspberry anthracnose	3
rose	38	mosaic	7
strawberry	6	Rust on apple	61
tulip tree	1	ash	1
Mildew on apple	10	cedar	1
catalpa	19	Crataegus	4
gooseberry	1	quince	6
grape	4	white pine blister on *Ribes*	9
lilac	12		

From an examination of the preceding list it will be seen that the green apple aphid was found in more nurseries (43) than any other insect pest, though this does not mean that it causes the most injury. Next in number of nurseries infested comes the oyster-shell scale (39), followed by the woolly apple aphid (35), leafhoppers on apple (35), spruce gall aphid (35), lace bugs on rhododendron (23), birch leaf miner (20), pear blister mite (20), San José scale (19), apple and thorn skeletonizer (19), and cherry and pear slug (17).

Among the plant diseases found in nurseries, seemingly the rust on apple leads in prevalence (61), followed in the order given, by mildew on rose (40), apple scab (38), leaf spot on rose (38), poplar canker (32), black rot on apple (26), leaf spot on catalpa (21), mildew on catalpa (19), mildew on lilac (12), and mildew on apple (10).

In order to show how the prevalence of certain nursery pests in 1926 compares with preceding seasons, the record of them for the past seven years is given as reported by the nursery inspectors:

SEVEN-YEAR RECORD OF SERIOUS AND COMMON NURSERY PESTS

Pest	1920	1921	1922	1923	1924	1925	1926
Oyster-shell scale	38	36	44	42	44	38	39
San José scale	11	28	19	20	32	32	19
Spruce gall aphids	21	31	21	28	40	27	42
White pine weevil	1	1	19	17	5	5	8
Apple and thorn skeletonizer	..	..	1	18	2	8	19
Poplar canker	13	21	31	34	25	34	32
Pine blister rust (on *Ribes*)	..	2	9	6	8	7	9
Nurseries uninfested	46	36	36	32	33	34	46

The figures in the preceding table are not absolutely comparable because the number of nurseries inspected in 1925 and 1926 was about 50 per cent greater than during the other years imme-

diately preceding. Though the number of nurseries infested with a given pest may be greater in 1926 than in 1923, the percentage may be considerably less.

Number of Nurseries

The law passed in 1925 requiring nurserymen to register has operated to increase the number of nursery firms known to the State Entomologist. This increase was marked in 1925, and further increases have been noted in 1926. During the calendar year of 1926, 182 nursery inspections were made. The list contains 162 names; 12 of these were inspected twice, once in the spring and again in the fall, and 174 regular certificates have been granted. Eight inspections were made where the owners either have not qualified for receiving certificates or have since decided that they do not need certificates.

In addition to these regular inspections and certificates, 121 separate parcels of nursery stock have been inspected and package certificates furnished; 202 duplicate certificates have been furnished to the regular nurserymen for filing in other states.

The area of nurseries in Connecticut in 1926 was about 2,106 acres, as against 2,731 in 1925. These figures are for the most part taken from the registration blanks, and where not filled out by the owner, the inspector obtains the information, or if this is not possible, he estimates the area. All nurseries of less than an acre are given as one acre. Likewise, wherever a fraction is given, the next whole number is recorded. The list of nursery firms for 1926 contains 162 names, and is as follows:

Nursery Firms in Connecticut Receiving Certificates in 1926

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Alius, Adolf	Stamford	1	Nov. 1	299
Amelunxen & De Wyn	Yalesville	3	Sept. 3	235
Baby Blue Spruce Gardens (E. C. Pomeroy, Prop.)	New Milford	2	Aug. 14	182
Barnes Bros. Nursery Co.	Yalesville and Durham	150	Aug. 6	169
Barnes Nursery & Orchard Co.	Wallingford	50	Oct. 21	294
Barton, Robert	Hamden	1	Dec. 7	311
Beattie, W. H.	New Haven	1	Dec. 22	319
Benbow, A.	Norfolk	1	Aug. 21	192
Berkshire Nurseries (C. B. Myers, Mgr.)	Milford	10	Dec. 30	324
Bernson, Gosta M.	Cromwell	1	Aug. 21	203
Bertana, Louis (2)	Glenbrook	1	Sept. 15	264
Bertolf Bros.	Greenwich	40	Sept. 15	263
Booy, H. W.	Yalesville	3	Aug. 21	199
Brainard Nursery & Seed Co.	Thompsonville	12	Aug. 20	188
Braley & Co. S A.	Burnside	3	Aug. 31	216

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Branford Nurseries	Branford	4	Aug. 31	217
Bretschneider, A.	Danielson	1	Sept. 4	236
Bridgeport Hydraulic Co.	Bridgeport	100	Oct. 26	295
Bristol Nurseries, Inc.	Bristol	30	Sept. 7	240
Brooklawn Conservatories (Julius Reck, Prop.)	Bridgeport	1	Aug. 27	212
Brouwer's Nurseries	New London	2	Aug. 21	194
Brown, Edgar M.	Hartford	1	Oct. 26	296
Bulpitt, Henry F.	Darien	4	Nov. 17	307
Burke, P. J. (2)	Rockville	2	Aug. 21	196
Burr & Co., C. R.	Manchester, Ellington and Durham	300	Aug. 19	183
Burr, Morris L.	Westport	1	Oct. 19	291
Burroughs, Thomas E.	Deep River	4	Aug. 5	168
Burwell, E. E. (2)	New Haven	1	Sept. 30	281
Cant, Alexander	Springdale	1	Sept. 27	277
Cardarelli, E. J.	Cromwell	2	Sept. 8	250
Case, Louis L. (2)	Simsbury	1	Sept. 7	244
Chapman, C. B.	Groton	1	Sept. 16	268
Chapman, C. E.	North Stonington	1	Sept. 8	247
Clinton Nurseries (Warren W. Richards, Prop.)	Clinton	4	Sept. 14	257
Conine Nursery Co.	Stratford	50	Sept. 2	222
Conn. Agricultural College (Prof. S. P. Hollister)	Storrs	1	Sept. 11	255
Conn. Agr. Expt. Station (W. O. Filley, Forester)	Mt. Carmel, New Haven and Norwich	2	Sept. 18	273
Corrigan, James J.	West Haven	1	Aug. 27	215
Dallas, Inc., Alexander	Waterbury	2	Oct. 27	297
Dawson's Nursery	Willimantic	1	Sept. 14	261
Dunlap, Daniel S.	Cromwell	3	Aug. 21	202
Eager, Edward M.	Bridgeport	1	Sept. 21	275
East Rock Nursery Co. (S. Palmieri, Prop.)	New Haven	1	Sept. 28	278
Edgewood Nursery (Vidal Mackintosh, Inc.)	Stamford	1	Dec. 6	310
Eells & Sons	Manchester	1	Aug. 14	181
Elfgren, I. P. (2)	East Killingly	1	Aug. 21	205
Elm City Nursery Co. (Woodmont Nurseries, Inc.)	Woodmont	150	Aug. 25	207
Elm Grove Cemetery Association	Mystic	1	Dec. 4	309
Ensign-Bickford Co. (S. W. Eddy, Supt.)	Avon	10	Dec. 28	323
Evergreen Nursery Co.	Wilton and South Wilton	14	Aug. 14	180
Farmington Valley Nursery (Harry D. Wilcox, Prop.)	Avon	1	Aug. 31	221
Fraser's Nurseries & Dahlia Gardens	Willimantic	2	Aug. 21	204
Galligan, C. W.	North Haven	2	Sept. 3	233
Gardner's Nurseries	Rocky Hill	4	Aug. 25	206
Geduldig's Greenhouses	Norwich and Ledyard	2	Sept. 9	251
Geremia, Joseph	Yalesville	1	Sept. 7	241
Glen Terrace Nursery (J. H. Everett, Prop.)	Mount Carmel	20	Oct. 4	285

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Golden Hill Nurseries (Andrew Johnson, Prop.)	Shelton	2	Sept. 7	243
Hallock, H. G.	Washington	1	Sept. 3	228
Hanford, R. G.	Norwalk	2	Aug. 31	219
Hansen, Peter	Fairfield	2	Sept. 10	253
Hawes, F. M.	West Hartford	1	Sept. 3	225
Hearn, Thomas H.	Washington	3	Sept. 3	229
Heath & Company	Manchester	1	Aug. 6	172
Hill Top Nursery (2) (F. W. Langstroth, Prop.)	Danbury	2	Sept. 3	224
Hilliard, H. J.	Sound View	1	Aug. 31	220
Hiti Nurseries (J. H. Bowditch, Prop.)	Pomfret Center	8	Aug. 6	170
Holcomb, Irving	Simsbury	1	Aug. 11	178
Holdridge, S. E.	Ledyard	4	Aug. 19	185
Horan, James & Son	Bridgeport	1	Oct. 6	287
Houston's Nurseries	Mansfield	12	Oct. 19	292
Hoyt's Sons Co., Inc., Stephen	New Canaan	300	Aug. 26	211
Hubbard, S. C.	Cromwell	2	Aug. 21	201
Hull, Curtis M.	Wallingford	4	Sept. 15	266
Hunt & Co., W. W.	Hartford	8	Sept. 3	223
Intravaia, Joseph	Middletown	2	Aug. 21	197
Jennings, G. S.	Southport	1	Sept. 7	242
Johnson, Tom	Stratford	1	Apr. 14	156
Jones, William	Norwalk	1	Sept. 11	254
Kelley, James J. & Son	New Canaan	4	Sept. 8	245
Kerner, Eugene	Woodbury	2	Dec. 31	325
Keystone Nurseries (H. H. Kellner, Prop.)	Danbury	1	Aug. 25	208
Leghorn, John J.	Cromwell	5	Aug. 19	186
Lewis & Valentine, Inc.	Darien	5	Oct. 27	298
Long Hill Nursery (John E. Eckner, Prop.)	Burnside	1	Sept. 3	226
Malavasi, Sam	New Haven	1	Sept. 30	282
Mallett Co., George A.	Bridgeport	1	Sept. 14	259
Maplewood Nurseries (T. H. Peabody, Mgr.)	Norwich	2	Sept. 27	276
Marigold Farm (Henry Kelley, Prop.)	New Canaan	10	Sept. 18	271
Marshall, Robert	Wethersfield	1	Sept. 4	238
Massara, Anthony	Yalesville	1	Aug. 21	200
Merwin Lane Nursery (J. W. Marvin, Jr., Prop.)	Fairfield	5	Oct. 2	283
Middeleer, Inc.	Darien	6	Nov. 6	303
Millane Tree Expert Co.	Middletown and Cromwell	2	Dec. 1	308
Minge, G. H. (2)	Rocky Hill	1	Sept. 28	279
Moraio Bros.	Stamford	1	Apr. 14	157
Morgan, William F. (Westerly, R. I.)	North Stonington	4	Sept. 8	249
New Britain Board of Water Commissioners (2)	New Britain and Southington	50	Nov. 6	302
New Haven Nurseries (Louis A. Soldan, Mgr.)	New Haven	1	Dec. 8	313
New Haven Park Commission (G. X. Amrhyn, Supt.)	New Haven	16	Sept. 8	246

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
New London Cemetery Assn. (E. E. Rogers, Pres.)	New London	1	Sept. 14	260
New London County Nurseries (W. J. Schoonman, Prop.)	New London, Norwich and Waterford	5	Sept. 29	280
Newington Gardens (Julius Rottenberg, Prop.)	Newington	1	Sept. 15	267
Nicolson & Thurston	Litchfield	1	Aug. 21	191
North-Eastern Forestry Co. (F. S. Baker, Mgr.)	Cheshire	56	July 30	166
Norwood Nursery	Hamden	1	Sept. 18	272
Oakland Nurseries	Manchester	5	Aug. 6	173
Ostergren, Herbert	Cromwell	2	Aug. 21	193
Outpost Nurseries (L. D. Conley, Prop.)	Ridgefield	35	Oct. 4	286
Ouwerkerk & Van der Stam	Yalesville	12	Aug. 19	187
Parfitt, Mary T.	New Milford	1	Nov. 1	300
Pedersen, Anthon	Stamford	2	Dec. 7	312
Pequod Nursery Co.	Yalesville	15	Aug. 5	167
Phelps & V. T. Hammer Co., The J. W.	Branford	2	Nov. 15	304
Pierson, A. N., Inc.	Cromwell	100	Aug. 11	174
Plumley, D. L.	Clintonville	1	Sept. 3	234
Polish Orphanage Farm	New Britain	1	Dec. 8	314
Reuman, Theodore H.	Stamford	1	Sept. 3	232
Ridgefield Florist & Nursery (W. Pinchbeck, Prop.)	Ridgefield	4	Sept. 15	262
Rockfall Nursery Co. (Philip Marotta, Prop.)	Rockfall	70	Aug. 26	210
Rowayton Greenhouses	Rowayton	1	Aug. 31	218
Rushworth, Edwin	Yalesville	1	Aug. 21	198
Russell, C. B.	Newington	1	Sept. 4	239
Saxe & Floto	Waterbury	2	Nov. 16	306
Schaeffer Bros. Nursery	Ledyard	3	Aug. 21	195
Scheepers, Inc., John	Stamford	15	Aug. 11	177
Schulze, Charles T.	Bethel	1	Nov. 15	305
Scott's Nurseries	Hartford	5	Dec. 11	317
Sierman, C. H.	Hartford	8	Sept. 20	274
Simonson, H. C. (2)	Plainville	2	Sept. 3	230
Snelgrove, S. J. (2)	Windsor	1	Sept. 3	231
Sniffin, Charles R. (2)	Granby	12	Aug. 27	213
South Wilton Nurseries (J. C. Van Heiningen, Prop.)	South Wilton	3	Aug. 19	184
Southport Nursery (L. Coari, Prop.)	Southport	15	Aug. 25	209
State Forest Nursery (A. F. Hawes, State Forester)	Simsbury	3	Sept. 4	237
State Street Nursery (John Natyzon, Mgr.)	New Haven	2	Sept. 17	269
Steck, Charles A.	Newtown	6	Oct. 20	293
Steck, Charles A., Jr.	Bethel	5	Dec. 23	320
Steck, Harold W.	Farmington	10	Dec. 8	315
Steck, Mrs. Sarah B.	Bethel	1	Dec. 23	321
Stratfield Nurseries (George R. Godfrey, Prop.)	Bridgeport	20	Dec. 13	318
Stratford Florist Co. (C. A. Cooper, Prop.)	Stratford	1	Sept. 10	252

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Stratford Rose Nurseries (John Barrow, Prop.)	Stratford	2	Sept. 3	227
Szirbik & Co., George	New Haven	1	Dec. 10	316
Tanner's Nursery Co.	Burnside	5	Sept. 14	258
Thomas, D. W., 2d	Hamden	1	Aug. 27	214
Upson, R. E.	Marion	4	Sept. 18	270
Van Wilgen Nurseries	Branford	8	Nov. 6	301
Vanderbrook & Son, Charles L.	Manchester	17	Aug. 6	171
Vasileff, Nicholas	Greenwich	2	Sept. 11	256
Verkade's Nurseries	New London and Chesterfield	15	Aug. 11	176
Wallace Nursery	Wallingford	8	Sept. 15	265
Wayside Farm Gardens (Miss I. E. Aldrich, Prop.)	Thomaston	2	Aug. 21	190
Wegner, Conrad F.	Noroton Heights	1	Dec. 28	322
Wheeler, Charles B.	North Stonington	1	Sept. 8	248
Wild, Henry	Greenwich and Norwalk	26	Aug. 20	189
Wilson & Co., C. E.	Manchester	75	Aug. 11	175
Woodruff, C. V.	Orange	1	Oct. 2	284
Wyllie, David (2)	Whitneyville	1	Oct. 6	288
Yale University Landscape Department (G. A. Cromie)	New Haven	3	Oct. 18	289
Yale University School of Forestry	New Haven	2	Oct. 18	290
Zack Co., H. J.	Deep River	5	Aug. 12	179
Total 162 nurseries		2,106 acres		

Bulletin of Immediate Information No. 57, on "Regulations Concerning the Transportation of Nursery Stock in the United States and Canada," was published in November and sent to all nursery firms on the preceding list. It gives a résumé of all Federal quarantines and of the requirements of each state concerning the shipping of nursery stock.

Inspection of Raspberry Plantations

Several raspberry growers and nurserymen applied for the special inspection and certificate in order to be able to sell plants free from mosaic. This inspection and certificate is necessary to meet the requirements of the states of Michigan, Minnesota, New York and Vermont. Consequently two inspections of each of three plantations were made by both entomologists and botanists. These were mostly in nurseries and some of them contained too much mosaic to warrant certification, but special certificates were granted to three firms on varieties as follows:

SPECIAL CERTIFICATES ON RASPBERRY PLANTS

Name of Firm	Address	Variety	Certificate Date of issue	Certificate Number
Barnes Nursery & Orchard Co.	Wallingford	Erskine Park Plum Farmer	Sept. 17	13
Burr & Co., C. R.	Manchester	Columbian Cumberland Cuthbert Golden Queen Marlboro Ohio	Sept. 17	14
Conine Nursery Co.	Stratford	Columbian Cuthbert La France Latham	Sept. 17	12

NURSERY DEALERS

According to Chapter 265, Public Acts of 1925, dealers in nursery stock must also register with the State Entomologist, giving the chief sources of their nursery stock. During the calendar year, 94 dealers were registered and permits granted. These dealers' permits were issued only for the remainder of the current year and all expired on December 31. The list of dealers is not printed in this Report.

OUT-OF-STATE NURSERYMEN

Nurserymen in other states desiring to ship nursery stock into Connecticut are required to file copies of their inspection certificates and make application for permits to ship stock into the State. Such permits are valid only for the period covered by the certificates placed on file. During the year 181 permits have been issued to nurserymen in other states, but the list of nurserymen receiving them is not included in this report.

INSPECTION OF IMPORTED NURSERY STOCK

W. E. BRITTON AND M. P. ZAPPE

During the past seven years the nursery stock entering Connecticut from foreign countries has been entirely fruit and rose seedlings for propagation. As in preceding seasons, this stock has been inspected mostly by Mr. Zappe, though he has been assisted in certain instances by Messrs. B. H. Walden and J. L. Rogers. The number of plants was greater than in 1925 and has been exceeded only in 1924, as the following table giving the statistics for the past seven years will show:

Year	No. of shipments	No. of cases	No. of plants
1920	17	87	814,491
1921	21	126	1,228,560
1922	30	159	1,997,595
1923	35	179	1,981,895
1924	33	313	3,489,170
1925	27	277	2,977,346
1926	32	347	3,443,357

These 32 shipments were imported by nine different Connecticut firms, 21 shipments being consigned to two firms. Of the total number of shipments, 21 shipments contained only rose stocks, six shipments contained only fruit stocks, and five shipments contained both rose and fruit stocks.

The time required to inspect this stock is equivalent to one man working 36 days, and this time, together with the cost of travel and other necessary expenses, amounts to about $500.00.

Of this plant material inspected, 1,889,507 or about 55 per cent were fruit seedlings, and 1,553,850 or about 45 per cent were rose stocks. The number of each variety is shown in the following table:

KINDS OF STOCKS IMPORTED

FRUIT STOCKS

Variety	Number of Plants	Total
Apple	860,507	
Apple, dwarf (Doucin)	20,000	
Cherry (Mahaleb)	372,000	
Cherry (Mazzard)	25,000	
Pear	413,000	
Plum (Myrobolan)	185,000	
Quince	14,000	1,889,507

ROSE STOCKS

Rosa manetti	1,279,050	
Rosa multiflora japonica	24,000	
Rosa rugosa	255,800	1,553,850
		3,443,357

Though the greatest number of shipments came from Holland, the greatest number of cases and plants came from France, as the following table will show:

SOURCES OF IMPORTED NURSERY STOCK, 1925-1926

Country	No. shipments	No. cases	No. plants
France	8	193	2,098,400
Holland	19	149	1,326,950
Ireland	2	2	8,000
England	1	1	10,000
Canada	2	2	7
	32	347	3,443,357

The following table shows the quantities of stock as inspected by months:

Month	No. shipments	No. cases	No. plants
November	1	2	15,000
December	6	35	303,000
January	8	108	919,400
February	8	161	1,859,000
March	2	4	41,900
April	3	21	160,050
May	4	16	145,007
	32	347	3,443,357

In addition to the material enumerated and tabulated above, there was one shipment of seven cases which was probably received and unpacked through a mistake, though the number of plants was not given, and 25 shipments containing 32 packages of seeds, mostly of trees and palms, which were not inspected in Connecticut.

Of the 32 shipments inspected, 13 shipments, or about 40 per cent, were found infested with insects or plant diseases, some of which are well-known pests. Details regarding these pests are given below.

Pests Found on Imported Nursery Stock

13 Shipments Infested

INSECTS

Acronycta sp. on apple (1 shipment). Andre Choplin, Angers, France.

Acronycta rumicis on pear (1 shipment). Andre Choplin, Angers, France.

Emphytus cinctus Linn. on rose (9 shipments). Felix & Dykhuis, Boskoop, Holland; A. Fermaud, Franco-American Seedling Co., Angers, France; Oudyk Bros., Boskoop, Holland; Fa. As. Ouwerkerk, Boskoop, Holland; Aug. Rolker & Sons, Veendam, Holland.

Euproctis chrysorrhoea Linn. egg mass on pear (1 shipment). A. Fermaud, Franco-American Seedling Company, Angers, France.

Notolaphus antiqua Linn. (3 shipments) 2 on rose, 1 on apple. Andre Choplin, Maze, France; (egg mass) A. Fermaud, Franco-American Seedling Co., Angers, France; C. Klijn & Co., Boskoop, Holland.

Rhabdophaga salicis Schrank galls on tying willows (1 shipment). Oudyk Bros., Boskoop, Holland.

Rose scale on manetti (1 shipment). A. Fermaud, Franco-American Seedling Co., Angers, France.

Woolly aphis on apple (2 shipments). Andre Choplin, Maze, France; A. Fermaud, Franco-American Seedling Co., Angers, France.

PLANT DISEASES

Crown gall on pear (1 shipment). A. Fermaud, Franco-American Seedling Co., Angers, France.

INSPECTION OF APIARIES IN 1926

In 1926, as for several years past, the apiary inspection work has been done by Messrs. H. W. Coley of Westport and A. W. Yates of Hartford, on a *per diem* basis. Mr. Coley covers the southern half of the State (Fairfield, New Haven, Middlesex, and New London Counties), and Mr. Yates the northern half (Litchfield, Hartford, Tolland, and Windham Counties).

This work required a total of 194 man days and the entire cost for the season of 1926 was $1,918.35. In all, 814 apiaries, containing 7,923 colonies, were inspected in 1926 as against 766 apiaries containing 8,257 colonies in 1925. The apiaries averaged 9.7 colonies each in 1926, and 10.7 each in 1925.

The following table shows the number of apiaries and colonies inspected and the average number of colonies per apiary, as well as the cost per apiary and colony for each year since the inspection work was commenced in 1910:

SEVENTEEN-YEAR RECORD OF APIARY INSPECTION IN CONNECTICUT

Year	No. of Apiaries	No. of Colonies	Average No. Colonies Per Apiary	Average Cost of Inspection Per Apiary	Average Cost of Inspection Per Colony
1910	208	1,595	7.6	$2.40	.28
1911	162	1,571	9.7	1.99	.21
1912	153	1,431	9.3	1.96	.21
1913	189	1,500	7.9	1.63	.21
1914	463	3,882	8.38	1.62	.19
1915	494	4,241	8.58	1.51	.175
1916	467	3,898	8.34	1.61	.19
1917	473	4,506	9.52	1.58	.166
1918	395	3,047	7.8	1.97	.25
1919	723	6,070	11.2	2.45	.29
1920	762	4,797	6.5	2.565	.41
1921	751	6,972	9.2	2.638	.24
1922	797	8,007	10.04	2.60	.257
1923	725	6,802	9.38	2.55	.27
1924	953	8,929	9.4	2.42	.25
1925	766	8,257	10.7	2.45	.22
1926	814	7,923	9.7	2.35	.24

In 1926, apiaries were inspected in 137 towns, as against 118 towns in 1925, and 149 towns in 1924.

Inspections were made in the following 30 towns in 1926 which were not visited in 1925: Fairfield County—Brookfield, Fairfield, Newtown; New Haven County—East Haven, Middlebury, North Branford, Orange; Middlesex County—Middlefield; New London County—Ledyard, North Stonington; Litchfield County—Bridgewater, Kent, New Milford, Roxbury, Washington, Woodbury; Hartford County—Enfield, New Britain, Plainville, Southington; Tolland County—Bolton, Ellington, Somers, Stafford,

Tolland, Union, Vernon, Willington; Windham County—Ashford, Pomfret.

On the other hand, the following 12 towns, where inspections were made in 1925, were not visited by the inspectors in 1926: Shelton in Fairfield County; Cheshire and Seymour in New Haven County; Essex and Saybrook in Middlesex County; Plymouth in Litchfield County; Marlborough, South Windsor and Windsor Locks in Hartford County; Hebron in Tolland County; Chaplin and Thompson in Windham County.

European Foul Brood

This bacterial disease of the young larvae caused by *Bacillus pluton* is known as European foul brood, and is more troublesome in spring and early summer than at other periods of the year. Usually the cell contents are not ropy or gelatinous, and though often with the odor of fermentation, it is not very offensive. The common treatment is to requeen the diseased colonies with Italian queens, and to unite two or more weak colonies in order to make them all as strong as possible.

Of the 814 apiaries and 7,923 colonies inspected in 1926, 26 apiaries and 68 colonies were found infested with European foul brood. This is 3.19 per cent of the apiaries and .858 per cent of the whole number of colonies inspected during the season—a somewhat larger percentage of both apiaries and colonies than has been found diseased with European foul brood since 1922.

The following table shows the records regarding European foul brood in Connecticut since the inspection work began in 1910:

RECORD OF EUROPEAN FOUL BROOD

Year	Percentage of Infestation		Year	Percentage of Infestation	
	Apiaries	Colonies		Apiaries	Colonies
1910	75.9	49.7	1919	6.6	1.2
1911	51.8	27.4	1920	4.3	1.5
1912	47.7	23.5	1921	3.91	1.26
1913	44.4	24.5	1922	4.14	.85
1914	32.6	13.9	1923	2.34	.36
1915	26.1	10.3	1924	1.78	.526
1916	18.8	7.05	1925	2.48	.507
1917	16.7	4.86	1926	3.19	.858
1918	9.8	3.3			

During 1926, European foul brood was found only in the following towns: Naugatuck in New Haven County; North Stonington in New London County; Brooklyn, Killingly, Plainfield and Putnam in Windham County; Coventry in Tolland County; Canton and New Britain in Hartford County; Harwinton, Kent, Roxbury, Thomaston and Winchester in Litchfield County. None was found in Fairfield or Middlesex Counties, as was the case in 1925.

American Foul Brood

This is also a bacterial disease of the larvae, and is caused by *Bacillus larvae,* but it attacks the brood at a later stage of its development than does the disease called European foul brood. It usually shows when the larvae are mature and pupating after the cells are sealed. The diseased cells are shrunken, and if broken open, the contents have a peculiar ropy or stringy consistency and give off a very offensive odor. The treatment has been to shake the colonies into clean hives, destroy the infected combs, and disinfect the old hives. Now it is feasible to sterilize the diseased combs by soaking them in an alcohol-formalin solution containing 20 per cent of formalin, after which they may safely be used.

Of the 814 apiaries and 7,923 colonies inspected in 1926, 14 apiaries and 23 colonies were found diseased with American foul brood. This is 1.72 per cent of the apiaries and .29 per cent of the whole number of colonies inspected in 1926. This is a smaller percentage of both apiaries and colonies than was found in 1925.

The following table gives a complete record regarding American foul brood since apiary inspection was initiated in Connecticut in 1910:

RECORD OF AMERICAN FOUL BROOD

Year	Percentage of Infestation Apiaries	Colonies	Year	Percentage of Infestation Apiaries	Colonies
1910	0	0	1919	3.	1.1
1911	0	0	1920	1.18	.25
1912	0	0	1921	2.5	.56
1913	0	0	1922	1.38	.27
1914	1.07	.7	1923	.965	.323
1915	.8	.18	1924	1.04	.22
1916	1.07	.15	1925	3.26	.424
1917	.42	.17	1926	1.72	.29
1918	1.01	.32			

During 1926, American foul brood was found in the following towns: Greenwich and Stamford in Fairfield County; Madison and Middlebury in New Haven County; Bozrah, Ledyard and Norwich in New London County; Litchfield and Watertown in Litchfield County; Suffield in Hartford County; Andover in Tolland County.

Sacbrood

Sacbrood or pickled brood is a disease often mistaken for American or European foul brood. The cause is considered to be a filterable virus. The larvae die about the time the cells are capped and lie on their backs with heads turned upward. The body is swollen and contents watery, but there is no ropiness, and the entire cell contents may easily be removed intact as if enclosed

in a sac. The color is variable, though often light yellow or brown, with head nearly black. The usual treatment is to make strong colonies by uniting the weak ones. In certain rare cases where whole apiaries become infected, new queens should be supplied to all the colonies.

The following table shows the record of sacbrood since apiary inspection in Connecticut started in 1910:

RECORD OF SACBROOD

Year	Percentage of Infestation Apiaries	Colonies	Year	Percentage of Infestation Apiaries	Colonies
1910	0	0	1919	1.24	.19
1911	..	.51	1920	1.18	.229
1912	..	Several	1921	1.06	.157
1913	..	2.8	1922	1.37	.187
1914	2.59	.721	1923	.53	.086
1915	2.02	.47	1924	1.78	.52
1916	.428	.051	1925	3.39	.836
1917	1.48	.199	1926	1.1	.138
1918	.253	.032			

Statistics of Inspection

The statistics of apiary inspection by towns and counties may be found in the following pages, with summary on page 198:

INSPECTION OF APIARIES, 1926

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Foul Brood Sacbrood
Fairfield County:							
Bethel	6	1	63	1	0	0	1
Brookfield	2	0	68	0	0	0	0
Danbury	5	0	80	0	0	0	0
Darien	4	0	49	0	0	0	0
Easton	4	0	99	0	0	0	0
Fairfield	6	0	93	0	0	0	0
Greenwich	14	1	128	1	1	0	0
New Canaan	6	1	76	1	0	0	1
Newtown	5	0	112	0	0	0	0
Norwalk	7	1	91	1	0	0	1
Redding	2	0	8	0	0	0	0
Ridgefield	6	0	61	0	0	0	0
Stamford	15	1	201	1	1	0	0
Westport	1	0	8	0	0	0	0
Wilton	8	0	170	0	0	0	0
	91	5	1,307	5	2	0	3
New Haven County:							
Beacon Falls	2	0	52	0	0	0	0
Branford	3	0	25	0	0	0	0
Derby	3	0	17	0	0	0	0
East Haven	2	0	13	0	0	0	0
Guilford	2	0	23	0	0	0	0
Madison	2	1	26	3	3	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Sacbrood
New Haven County—*cont.*							
Meriden	7	0	137	0	0	0	0
Middlebury	3	1	31	1	1	0	0
Naugatuck	4	1	45	2	0	2	0
North Branford	1	0	26	0	0	0	0
North Haven	5	1	43	2	0	0	2
Orange	2	0	8	0	0	0	0
Prospect	5	1	35	1	0	0	1
Wallingford	14	1	101	1	0	0	1
Waterbury	4	0	28	0	0	0	0
	59	6	610	10	4	2	4
Middlesex County:							
Chester	4	0	39	0	0	0	0
Clinton	4	1	60	2	0	0	2
Cromwell	3	0	22	0	0	0	0
Durham	5	0	103	0	0	0	0
East Haddam	7	0	230	0	0	0	0
East Hampton	12	0	167	0	0	0	0
Haddam	3	0	67	0	0	0	0
Killingworth	2	0	9	0	0	0	0
Middlefield	3	0	58	0	0	0	0
Middletown	5	0	61	0	0	0	0
Old Saybrook	2	0	20	0	0	0	0
Portland	5	0	35	0	0	0	0
Westbrook	2	1	4	1	0	0	1
	57	2	875	3	0	0	3
New London County:							
Bozrah	3	2	109	4	3	0	1
Colchester	6	0	44	0	0	0	0
East Lyme	2	0	55	0	0	0	0
Franklin	1	0	24	0	0	0	0
Griswold	4	0	92	0	0	0	0
Groton	4	0	48	0	0	0	0
Lebanon	10	0	129	0	0	0	0
Ledyard	3	1	30	1	1	0	0
Lisbon	2	0	30	0	0	0	0
Lyme	1	0	42	0	0	0	0
Montville	3	0	29	0	0	0	0
North Stonington	4	1	47	1	0	1	0
Norwich	11	1	464	1	1	0	0
Old Lyme	4	0	67	0	0	0	0
Preston	2	0	22	0	0	0	0
Salem	2	0	24	0	0	0	0
Sprague	1	0	12	0	0	0	0
Stonington	5	0	58	0	0	0	0
Voluntown	2	0	15	0	0	0	0
Waterford	2	0	52	0	0	0	0
	72	5	1,393	7	5	1	1
Litchfield County:							
Barkhamsted	3	1	22	1	1	0	0
Bethlehem	10	0	33	0	0	0	0
Bridgewater	5	0	92	0	0	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Sacbrood
Litchfield County—*cont.*							
Canaan	1	0	6	0	0	0	0
Colebrook	6	0	35	0	0	0	0
Cornwall	11	0	76	0	0	0	0
Goshen	5	0	41	0	0	0	0
Harwinton	6	2	25	4	0	4	0
Kent	6	1	57	4	0	4	0
Litchfield	14	2	172	6	6	0	0
Morris	5	0	12	0	0	0	0
New Hartford	5	0	20	0	0	0	0
New Milford	14	0	121	0	0	0	0
Norfolk	2	0	11	0	0	0	0
North Canaan	2	0	61	0	0	0	0
Roxbury	3	1	16	1	0	1	0
Salisbury	6	0	24	0	0	0	0
Sharon	5	0	87	0	0	0	0
Thomaston	2	1	14	1	0	1	0
Torrington	9	0	85	0	0	0	0
Washington	8	0	137	0	0	0	0
Watertown	14	1	47	1	1	0	0
Winchester	8	1	52	1	0	1	0
Woodbury	6	0	76	0	0	0	0
	156	10	1,322	19	8	11	0
Hartford County:							
Avon	3	0	22	0	0	0	0
Berlin	10	0	153	0	0	0	0
Bloomfield	2	0	45	0	0	0	0
Bristol	14	0	75	0	0	0	0
Burlington	6	0	25	0	0	0	0
Canton	12	1	56	2	0	2	0
East Granby	5	0	25	0	0	0	0
East Hartford	6	0	33	0	0	0	0
East Windsor	6	0	12	0	0	0	0
Enfield	8	0	45	0	0	0	0
Farmington	12	0	41	0	0	0	0
Glastonbury	16	0	152	0	0	0	0
Granby	5	0	58	0	0	0	0
Hartford	5	0	24	0	0	0	0
Hartland	2	0	28	0	0	0	0
Manchester	12	0	84	0	0	0	0
New Britain	13	2	103	7	0	7	0
Newington	9	0	47	0	0	0	0
Plainville	3	0	12	0	0	0	0
Rocky Hill	6	0	38	0	0	0	0
Simsbury	6	0	40	0	0	0	0
Southington	14	0	46	0	0	0	0
Suffield	14	1	80	3	3	0	0
West Hartford	8	0	84	0	0	0	0
Wethersfield	5	0	30	0	0	0	0
Windsor	11	0	58	0	0	0	0
	213	4	1,416	12	3	9	0
Tolland County:							
Andover	4	1	17	1	1	0	0
Bolton	1	0	6	0	0	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Foul Brood Sacbrood
Tolland County—*cont.*							
Columbia	3	0	16	0	0	0	0
Coventry	16	1	98	2	0	2	0
Ellington	10	0	35	0	0	0	0
Mansfield	4	0	31	0	0	0	0
Somers	3	0	6	0	0	0	0
Stafford	13	0	29	0	0	0	0
Tolland	4	0	38	0	0	0	0
Union	3	0	8	0	0	0	0
Vernon	6	2	39	2	0	2	0
Willington	14	0	56	0	0	0	0
	81	4	379	5	1	4	0
Windham County:							
Ashford	2	0	13	0	0	0	0
Brooklyn	2	1	134	10	0	10	0
Canterbury	6	0	41	0	0	0	0
Hampton	3	0	55	0	0	0	0
Killingly	12	2	55	2	0	2	0
Plainfield	22	7	100	18	0	18	0
Pomfret	9	0	55	0	0	0	0
Putnam	5	2	39	11	0	11	0
Scotland	6	0	24	0	0	0	0
Sterling	6	0	17	0	0	0	0
Windham	8	0	57	0	0	0	0
Woodstock	4	0	31	0	0	0	0
	85	12	621	41	0	41	0

SUMMARY

County	No. Towns	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Foul Brood Sacbrood
Fairfield	15	91	5	1,307	5	2	0	3
New Haven	15	59	6	610	10	4	2	4
Middlesex	13	57	2	875	3	0	0	3
New London	20	72	5	1,393	7	5	1	1
Litchfield	24	156	10	1,322	19	8	11	0
Hartford	26	213	4	1,416	12	3	9	0
Tolland	12	81	4	379	5	1	4	0
Windham	12	85	12	621	41	0	41	0
	137	814	48	7,923	102	23	68	11

	No. Apiaries	No. Colonies
Inspected	814	7,923
Infested with European foul brood	26	68
Per cent infested	3.19	.858
Infested with American foul brood	14	23
Per cent infested	1.72	.29
Infested with sacbrood	9	11
Average number of colonies per apiary		9.73
Cost of inspection		$1,918.35
Average cost per apiary		2.35
Average cost per colony		.24

GIPSY MOTH WORK IN CONNECTICUT IN 1926

By W. E. Britton and John T. Ashworth

The work has been continued in about the same manner as during the past few years, and is carried on co-operatively—by the State and the Federal Bureau of Entomology. As in former years the Federal forces, being interested particularly in preventing the further spread of the pest, have taken over the scouting of the territory along the boundary of the infested area, and the State forces, for the most part, have worked back from the margin in the territory known to be infested. We here express our thanks and appreciation to Messrs. A. F. Burgess and H. L. Blaisdell, in charge of Federal gipsy moth work, in acknowledgment of many courtesies and of their hearty co-operation.

Perhaps the outstanding features of the work during the season were the discovery of an infestation in Greenwich, near the boundary of New York State, and of another rather large one in Woodstock, both of which it is believed can be handled without unusual difficulty.

Present Equipment

At present the force consists of 48 men, eleven of whom are rated as foremen, and work as eight scouting crews. The work is supervised by Messrs. Ashworth and McEvoy. During the season for spraying, in May and June, as many men as are needed are detailed to operate the spray outfits.

The present motor vehicle equipment consists of one Buick six-cylinder touring car, one Dodge four-cylinder touring car, eight Ford light delivery trucks, and two Netco trucks fitted with Fitzhenry-Guptill power sprayer outfits.

A horse-drawn power sprayer purchased many years ago is still available for use if needed. About 3,150 feet of one-inch high-pressure spray hose and 150 feet of suction hose are also on hand.

The storehouse rented on North Main Street, Danielson, is fitted with rented gasoline tank and pump, and is well equipped with small tools, Ford parts, tires and tubes, so that most of the repair work can be done by our own men.

Financial Statement

RECEIPTS

Appropriation for biennial period ending June 30, 1927	$100,000.00

CLASSIFIED EXPENDITURES FOR THE YEAR ENDING JUNE 30, 1926

Salaries and Wages	$45,868.97	
Printing and Illustrations	70.44	
Postage	21.26	

Stationery and Office Supplies	$ 41.01	
Telegraph and Telephone	91.15	
Insurance	805.80	
Spraying Supplies	58.78	
Machinery, Tools and Supplies	227.44	
Express, Freight and Cartage	5.56	
Automobiles: Rental and Storage	586.80	
Repairs and Supplies	4,711.38	
Traveling Expenses	377.36	
Heat and Light	183.94	
Inspection of Imported Nursery Stock	54.32	
Miscellaneous	21.35	
		$53,125.56
Balance		46,874.44
		$100,000.00

Details of Work by Counties and Towns

The following pages give a detailed account of the scouting, spraying, and other control measures in towns. All egg-clusters found were treated with creosote to prevent hatching. The statistics are given in the tables beginning on page 212 and are summarized on page 215.

WINDHAM COUNTY

All the work in Windham County this year was done by men being trained, and both State and Federal men were taught different phases of the work in the towns named below. Conditions as to degree of infestation were found to be about the same as in the previous two or three years; it will be noted that in other years this section of the State has been the most heavily infested. Following is a detailed report of the work done in the towns of Windham County:

Brooklyn—11 Infestations—943 Egg-clusters

From the large number of egg-clusters found, Brooklyn would seem to be badly infested, but of this total, 790 egg-clusters were in two colonies. The largest one was in oak and birch growth on land owned by B. Marott, on the south slope of Allen Hill, where 700 egg-clusters were found; the other colony of 90 egg-clusters was on a maple tree on land owned by Edward Caffery, on the west side of Church Street. The other colonies were all small and not considered dangerous. The scouting in this town was done by Federal men, and the spraying by State men, nine of the eleven colonies being sprayed.

Eastford—59 Infestations—1,407 Egg-clusters

Eastford was one of the towns used for training men and was only about two-thirds covered, the work being confined to the northern portion of the town or the territory north of Phoenix-

ville. Three colonies were discovered, each of which contained more than 100 egg-clusters, but all were small in area. The largest had 194 egg-clusters, and was on an oak tree on land owned by J. B. Tatum, just north of the Eastford Post Office; another of 117 egg-clusters was on apple and elm trees owned by Mrs. Andert, about one mile east of the Cemetery. The third colony contained 113 egg-clusters, and was on four oaks owned by Mr. King on the same road and one-fourth of a mile farther east than the colony last mentioned. Twenty-nine of the infestations were sprayed during the summer by State men.

Hampton—6 Infestations—437 Egg-clusters

About thirty-four miles of roadside work were covered in the town of Hampton by State men being trained for this work. Two large colonies were discovered, one of 317 egg-clusters in woodland owned by Messrs. Smith and Stahkne, in the southeast corner of the town near the Canterbury line, and the other in apple trees in pasture owned by Mr. McLaughlin, in the south-central part of the town, near the Scotland line. The other four colonies were small, twenty egg-clusters being the largest, on fifteen white oaks owned by J. L. Goodwin, on the western border of the town just north of the State road. Three of the six colonies were found close together in this vicinity. Two of the six were sprayed by State men.

Killingly—56 Infestations—3,856 Egg-clusters

Killingly was used as a training school by Federal men, and several large colonies were discovered while scouting the town. At two of the places over 300 egg-clusters each were found, both colonies being on oak trees. The largest was on property owned by Mrs. Kanes, in the Goodyear district, where 350 egg-clusters were found and treated. The other colony was on land owned by Mr. Clark in South Killingly, containing 347 egg-clusters. The next largest was a colony of 217 egg-clusters scattered in woodland owned by A. A. Tillinghast, in the southeast corner of the town near what is known as the "Line Store" district; another colony of 167 egg-clusters was found on oak trees and in a stone wall on property owned by William Davis, near the "Old Furnace." These colonies were the largest, but several other colonies were found, ranging from thirty-five to fifty egg-clusters each, and scattered through all parts of the town. Thirty-five of the worst colonies were sprayed with arsenate of lead by State men.

Plainfield—6 Infestations—653 Egg-clusters

In scouting Plainfield, Federal men discovered two large colonies; one of 312 egg-clusters on oaks in a pasture owned by H. B. Brown, on the west slope of "Black Hill" near the Canterbury line, and the other in "Ekonk Hill" district, where 120 egg-clusters were found. All six of the colonies were in the southern half of the town. Several single egg-clusters were discovered in the northern half of the town, but no colonies. Four of the six colonies were sprayed by State men.

Putnam—30 Infestations—863 Egg-clusters

One colony of 144 egg-clusters and one of 78 egg-clusters were the two largest colonies found in Putnam. Both were on oaks, near the Windham County Children's Home. That of 144 egg-clusters was on land owned by A. Paquin, and that of 78 egg-clusters was on the property of the Home. A colony of 48 egg-clusters was found in oaks owned by A. Tourtellotte on Putnam Heights, and another colony of 48 egg-clusters was found in an oak grove, on the state road leading to Mechanicsville. Scouting in the town was done by Federal men. Twenty-six colonies were sprayed by the State crews.

Thompson—100 Infestations—7,158 Egg-clusters

Thompson was also used as a school for training men, by the Federal force. Two exceptionally large colonies in woodland were discovered. One containing 1,600 egg-clusters was found on property owned by W. Cassidy near Fabyan village. The other was in woodland owned by the Grosvenordale Company in North Grosvenordale, where 1,500 egg-clusters were found. Several colonies containing about 100 egg-clusters each were discovered. Two colonies of 200 egg-clusters each, and one of 225 egg-clusters were also found, all in oak woodland. Both of the 200 egg-cluster colonies were located in North Grosvenordale, one on land owned by Mr. Keegan, the other on land owned by the Grosvenordale Company. The 225 egg-cluster colony was on land owned by C. Cassidy near Fabyan. Thompson continues to be the most heavily infested town in the State, but it is very gratifying to know that the Tachinid parasites have become established and their work was noted this year. In the summer, spraying was done at 72 infestations by State men.

Woodstock—24 Infestations—5,848 Egg-clusters

In scouting Woodstock, Federal men discovered a colony of 5,000 egg-clusters in willow trees, on land owned by Messrs. Lowe and Ericson, at the south end of Roseland Pond. This was the

largest colony found in the state this year, though it was in low land and can be easily handled. Another colony of 200 egg-clusters was found in oaks in a pasture, about one mile north of the colony just mentioned. The next largest colony contained 150 egg-clusters on a pasture oak, on land owned by John Clark, about one mile northwest of the two colonies mentioned above. These three colonies were the only ones found in Woodstock which we consider of sufficient importance to mention in this report. Seventeen of the 24 colonies were sprayed by State men.

NEW LONDON COUNTY

All work done in New London County this year was done by State crews, but when this territory was reached it was so late in the season that scouting in some of the towns was not completed until larvae were hatched and crawling. In Groton, Norwich, Old Lyme, and Waterford, scouting was carried on throughout the summer. The following is a summary of the work in this County:

Colchester—2 Infestations—266 Egg-clusters

The work done in Colchester consisted of scouting around last year's infestations. Two places were reinfested. At the woodland colony owned by Edwin Brown, in the south-central part of the town, 256 egg-clusters were found, and 10 egg-clusters at Nicholas Clement's place, in the extreme southeastern corner of the town. Both colonies were sprayed about the middle of June, nearly 17 acres of woodland being treated.

Franklin

The work in Franklin this year, as in Colchester, consisted merely in scouting around the old infestations. About five miles of roadside work were covered but no infestations found.

Groton—9 Infestations—363 Egg-clusters

State men scouted Groton this year during the late spring and early summer. Four moderate-sized colonies were found. One of 123 egg-clusters was on roadside trees on property owned by W. T. Whyman, G. S. Avery, and the Spicer Coal and Ice Company in Groton village; another of 68 egg-clusters was found on apple and cherry trees owned by Mrs. Wagner and B. Porter in West Mystic. The third colony of 65 egg-clusters was on apple trees and in a stone wall on property owned by H. E. Bentley, in Noank village. The fourth colony of 50 egg-clusters was on apple and maple trees owned by the Sea Sled Company in West Mystic. The other five colonies were all small. Three of these places were sprayed in the summer by State men.

Ledyard—1 Infestation—6 Egg-clusters

Through a lucky accident, an infestation of six egg-clusters was discovered in the town of Ledyard this year. One of the men in the crew scouting in Groton wandered over the line into Ledyard and found this colony, which was sprayed on June 28.

Norwich—2 Infestations—20 Egg-clusters

Scouting was carried on in Norwich throughout the summer months, and two infestations were found. One of 19 egg-clusters was on willow trees owned by the New England Metal Company on Shipping Street. The other was a single egg-cluster, found on a maple in a yard owned by Thomas Heetman, near the Bozrah town line. The colony first mentioned was sprayed on the 26th and 28th of June.

Old Lyme

About one-third of the town was scouted and, no trace of the gipsy moth being found, the crew was then transferred to other work in the northeastern corner of the State.

Waterford

About three-quarters of the town of Waterford was scouted during the late spring and early summer. One single egg-cluster was found in an orchard along the north side of the New London-New Haven State road, just east of Jordan Brook. This crew was moved on July 15th, to take up other work in the northeastern corner of the State.

TOLLAND COUNTY

The same methods were used in Tolland County as in New London County; that is, scouting was confined to the areas around last year's infestations. This was necessary on account of the lateness in the season and the lack of men and money when this territory was reached. Nothing was found in Andover, Bolton, Coventry, Hebron, and Vernon. Other towns where scouting was done and gipsy moth colonies were found are as follows:

Columbia—3 Infestations—920 Egg-clusters

Three colonies were found in Columbia, all within an area of approximately one-half square mile. Two were on land owned by D. Topple, one in a stone wall and woodland containing 210 egg-clusters, and another of 35 egg-clusters in an old rail fence and mixed woodland. The third and largest colony was found in apple trees and a stone wall on land owned by Jake Ketsewitz,

where 675 egg-clusters were creosoted. These colonies were situated in the southwestern part of the town, and all three colonies were sprayed by State men.

Ellington—5 Infestations—25 Egg-clusters

Five small infestations were found in Ellington, the largest containing 21 egg-clusters. This colony was in white oaks in a pasture owned by Frank Gordiza, near the Somers' town line. All the other infestations were single egg-clusters. Spraying was not thought necessary.

Stafford—10 Infestations—228 Egg-clusters

Stafford was used by the Federal men as a training school and about one-half of the town was scouted. Ten colonies were found, the largest containing 81 egg-clusters, in pasture oaks owned by N. Cumber, about halfway between Orcuttville and Stafford Post Office. Another colony of 37 egg-clusters was found in an oak woodland border owned by J. Michlec, in the southeastern corner of the town near the Union and Willington town lines. The next largest colony was one of 22 egg-clusters in an orchard owned by J. Waytas, in the northeast corner of the town near the Massachusetts line. The other colonies were small. Seven of the ten colonies were sprayed by State men.

Tolland—1 Infestation—5 Egg-clusters

One colony of five egg-clusters was discovered on white oak trees on land owned by John E. Klough, near the center of the town. This colony was sprayed by State men.

HARTFORD COUNTY

Work was done in 25 of the 29 towns in Hartford County this year. Following is a summary of the work done in the towns:

Avon

Avon was scouted by State men but no trace of the gipsy moth found.

Bloomfield—2 Infestations—11 Egg-clusters

Two small infestations were discovered by State men. One of ten egg-clusters was in a woodland margin owned by George O. Sellew, on the western side of the town, along the State road leading over Simsbury Mountain. The other was a single egg-cluster on oak, on land owned by J. G. Hawley, about one-half mile south of Bloomfield depot. About two acres of woodland were sprayed by Federal men at Mr. Sellew's.

Bristol

State men scouted approximately fifty miles of roadway in Bristol, and, finding no trace of the gipsy moth, were transferred on May 15 to territory further east.

Burlington—3 Infestations—52 Egg-clusters

The scouting in Burlington was done by State men and was completed January 12. One colony and two small infestations were found, all three in apple orchards. The colony, containing 49 egg-clusters, was on property owned by Mr. Schuster, situated in the northwestern corner of the town. The other two infestations were small, containing one and three egg-clusters respectively. One hundred and fifty-eight shade and apple trees were sprayed at the colony noted above, by Federal men.

Canton—4 Infestations—1,342 Egg-clusters

In scouting Canton this year, the State men discovered four large colonies, three in woodland, and one in an apple orchard. The three woodland colonies were all situated in the northern end of the town; one of 1,033 egg-clusters on property owned by H. Smith and W. Freytag; one of 150 egg-clusters, owner unknown; and one of 107 egg-clusters on land owned by Arthur Sweeten. The fourth colony was one of 52 egg-clusters in an apple orchard, owned by L. B. Worth, near the center of the town. All four colonies were sprayed by Federal men.

East Granby—3 Infestations—42 Egg-clusters

State men scouted East Granby, the work being completed December 11. Thirty-seven of the 42 egg-clusters were on two willow trees and a fence rail, on property owned by Mr. Viets, about a half-mile east of East Granby Post Office.

East Hartford—3 Infestations—677 Egg-clusters

Three colonies were discovered by State men in East Hartford, all being situated in the southern end of the town. The largest colony was one of 654 egg-clusters, found on apple trees owned by John Penny, near the Glastonbury line. The other two were small colonies, about a mile northeast of the first, on land owned by F. W. Sheafer and H. E. Keeney. All three of these places were sprayed by State men.

East Windsor

The work in East Windsor this year consisted of scouting around the areas where infestations occurred last year. About fifteen miles of roadway were scouted and no infestations found, all work being done by State men.

Farmington—1 Infestation—11 Egg-clusters

A state crew scouted about two-thirds of the town and only one colony was found. This contained 11 egg-clusters and was in woodland owned by Roy Barnes, in the northeast corner of the town. This colony was sprayed by Federal men.

Glastonbury—2 Infestations—2 Egg-clusters

Scouting in Glastonbury was confined to the northern part of the town, in the section near the East Hartford and Manchester town lines. Thirty-eight miles of roadway were scouted and two single egg-cluster infestations were found. No further work was attempted in Glastonbury, as the season of scouting was getting late and the men were needed in other sections of the State.

Granby—20 Infestations—1932 Egg-clusters

In scouting Granby the State men discovered several large colonies this year. Three of them contained more than 300 egg-clusters each. One colony of 446 egg-clusters and another of 397 egg-clusters were in woodland owned by A. Luprun, and one of 378 egg-clusters in woodland and abandoned orchard owned by Max Shinder. All three of these colonies were situated in the extreme southwestern corner of the town. Another colony of 167 egg-clusters was found in woodland owned by A. R. Carpenter, about two miles west of West Granby Post Office. These four colonies were the largest in the town, the others being small—numbering 25 egg-clusters each. Twelve of the worst colonies were sprayed by Federal men, more than a ton and a quarter of lead arsenate being used.

Hartford—8 Infestations—1,151 Egg-clusters

Three large colonies were discovered in the City of Hartford by State men. The largest contained 798 egg-clusters, and was on property owned by A. Mather, on Windsor Avenue; the second, of 171 egg-clusters, was on an apple tree and shed owned by Kagan Brothers, on Windsor Avenue; the third, of 118 egg-clusters, was on poplar trees on Whitney Street. Five other small colonies were discovered and six of the eight infestations were sprayed by Federal men.

Hartland—13 Infestations—360 Egg-clusters

In scouting Hartland, State men discovered 13 infestations distributed over all parts of the town. There were only two colonies of moderate size: one of 120 egg-clusters on old apple trees in woodland owned by William Peck, in the northeast corner of the town, and another of 80 egg-clusters in a stone wall and trees in woodland owned by T. A. Howell, in the northwestern corner of the town. Five infestations were sprayed during the early summer by Federal men.

New Britain—2 Infestations—121 Egg-clusters

Two infestations were found in New Britain by State men. One of 118 egg-clusters was on land owned by the Polish Orphanage, on North Burritt Street, and the other was on apple and cherry trees owned by Messrs. Dynkowski and Bednan, on High Street. Both were sprayed by Federal men.

Simsbury—6 Infestations—166 Egg-clusters

Of the six infestations found by State men, only two of them contained more than ten egg-clusters each. One on oaks, at the Ethel Walker School, contained 112 egg-clusters, and the other on roadside trees on town property near Tariffville Post Office, contained 37 egg-clusters. Both of these colonies were sprayed by Federal men.

Suffield—13 Infestations—122 Egg-clusters

The 13 colonies found by State men were all small, the largest infestation containing 35 egg-clusters. This colony was on five oak trees in a field owned by Henry Sheldon, on the east side of the State road leading from West Suffield to East Granby, near the town line. The next largest was a colony of 19 egg-clusters in a woodland margin owned by Andrew Barrow, about two miles north of West Suffield village. The third largest colony was one of 18 egg-clusters on property owned by Jean Roy, situated about a mile north of West Suffield village. Most of the other infestations found in the town were single egg-clusters. Four infestations were sprayed by Federal men.

West Hartford—3 Infestations—364 Egg-clusters

State men scouted West Hartford this year and found three infestations, with a total of 364 egg-clusters: 361 were found on 11 willow trees owned by Mrs. J. F. Ryan, in the southern end of the town near the Newington line. All three colonies were within an area of half a square mile. The willow trees were all sprayed by Federal men.

Windsor—1 Infestation—2 Egg-clusters

State men discovered one infestation of two egg-clusters in the southern part of the town just north of the Fuller Brush Company's land. No further work was thought necessary at this infestation, as the egg-clusters were not broken, and when creosoted there was no danger of spread.

The work done in Newington, South Windsor and Wethersfield consisted of scouting around infested territory of previous years. Although approximately seventy miles of roadway were covered in these three towns, no trace of the gipsy moth was found. The following towns in Hartford County were completely scouted and no gipsy moth egg-clusters found: Manchester, Plainville, Rocky Hill, and Windsor Locks.

MIDDLESEX COUNTY

The four following towns in Middlesex County were scouted this year by State men and no trace of the gipsy moth was found: Cromwell, Durham, East Hampton and Middlefield.

NEW HAVEN COUNTY

The three towns of Meriden, Waterbury and Wolcott were scouted by State men, and the rest of the work in this County was done by Federal men. In Waterbury no gipsy moth infestations were discovered. Following is a description of the work done in the other two towns:

Meriden—2 Infestations—14 Egg-clusters

Both infestations found in Meriden were on street shade trees, one on East Main Street, containing 13 egg-clusters, and the other on Miller Street, of one egg-cluster; 215 trees were sprayed in the vicinity of East Main Street by Federal men.

Wolcott—3 Infestations—1,016 Egg-clusters

The three infestations found in Wolcott contained 1,016 egg-clusters, one of 997 egg-clusters being found in woodland owned by Thomas Zstko, about a half mile north of Wolcott Post Office; the other two infestations were about a quarter of a mile away. All three places were sprayed by Federal men.

The following towns in New Haven County were scouted by Federal men and no infestations found: Bethany, Cheshire, East Haven, Hamden, Middlebury, Naugatuck, New Haven, Orange, Prospect, Wallingford, and Woodbridge.

LITCHFIELD COUNTY

Seven towns in Litchfield County were found to be infested; five were scouted by State men, the other two by Federal men. The following is a detailed report of the work done in these seven towns:

Barkhamsted—10 Infestations—827 Egg-clusters

State men scouted Barkhamsted and found several large colonies, most of which were in woodland. The largest one contained 441 egg-clusters, in woodland owned by Michael Marek, situated about a mile south of Barkhamsted Post Office; the next largest colony was in woodland owned by Charles LeGeyt, in the north central part of the town near the Hartland line, where 34 egg-clusters were found. A cluster of three colonies was found on land owned by A. Malanchuk, about a mile east of the first colony mentioned, 139 egg-clusters being found on this property. Another colony of 90 egg-clusters was found in woodland about a quarter of a mile east of the last-mentioned colony. The other infestations were all small, 12 egg-clusters being the largest. Owing to bad roads and the distance of the infestations from the road, only five places were sprayed by Federal men. The spraying machines were equipped with about a half-mile of hose, but this was insufficient to reach to the colonies from the nearest point where the truck could be driven.

Colebrook—5 Infestations—28 Egg-clusters

Five small colonies were discovered by State men while scouting Colebrook this year, all of them situated along the western border of the town. One colony of 17 egg-clusters was on land owned by L. J. Phelps, and another of 7 egg-clusters was in woodland owned by G. T. Pentecost. Both of these colonies were sprayed by Federal men.

Harwinton—1 Infestation—414 Egg-clusters

Harwinton was scouted by State men. One infestation of 414 egg-clusters was found in woodland owned by Charles Delay, near Campville Post Office. This colony was sprayed by Federal men in the summer.

New Hartford—2 Infestations—117 Egg-clusters

Two large colonies were discovered by State men while scouting New Hartford this year. One of 66 egg-clusters was in a wood margin on property owned by Fred Weingart, near Bakersville

Post Office, and the other, of 51 egg-clusters, was in woodland owned by M. F. Ganon, in the Nepaug district. Both places were sprayed by Federal men in the summer.

Norfolk—3 Infestations—57 Egg-clusters

Norfolk was scouted by Federal men, and three infestations were found. All three were situated in the northeastern corner of the town and were woodland colonies. The largest, of 34 egg-clusters, was in birch growth, on land owned by Henry Lossin; the next, of 15 egg-clusters, was in birch growth on property owned by Mr. Laitinen; the third and smallest colony contained 8 egg-clusters and was on land owned by the Ansonia Produce Company. Spraying was done at two of these places by Federal men.

North Canaan—1 Infestation—12 Egg-clusters

Only one infestation was found in North Canaan by Federal men this year. This was a reinfestation of the large colony found on property owned by Charles Rosier, situated in the eastern end of the town near the Norfolk line; 12 egg-clusters were found just outside the territory sprayed last year. Six of the 12 egg-clusters were old and it was not thought necessary to do any spraying.

Plymouth—1 Infestation—5 Egg-clusters

The State men, while scouting Plymouth, discovered one small colony of 5 egg-clusters, on white oaks and an old rail fence on land owned by Mrs. Tolles, in the southeastern corner of the town, about one mile from the Wolcott town line. This colony was sprayed by Federal men.

Torrington and Winchester were both scouted by State men and nothing found. The following towns were scouted by Federal men and no infestations found: Bethlehem, Bridgewater, Canaan, Cornwall, Goshen, Kent, Litchfield, Morris, New Milford, Roxbury, Salisbury, Sharon, Warren, Washington, Watertown, and Woodbury.

FAIRFIELD COUNTY

All work in Fairfield County this year was done by Federal men. Ten towns were completely scouted and only one town, Greenwich, was found to be infested.

Greenwich—1 Infestation—328 Egg-clusters

A large colony was found in Greenwich in the extreme southwestern corner, 328 egg-clusters being found and creosoted. This colony was scattered over quite a large area, extending around the dump in that section of the town. There were several property owners, namely, S. Remella, Jos. Santera, Stewart Smart, Thomas Dopson, Thomas Fox and Bria Recio. A large area around this colony was sprayed in the summer in an endeavor to eradicate this colony this year, as the spread of the gipsy moth to this district is considered unnatural. Probably it was brought here by artificial means, as it is over fifty miles from the nearest infestation, which is in Wolcott. The accompanying photographs (Plates I and II) show some of the conditions around the Greenwich infestation.

The other nine towns scouted in Fairfield County were: Brookfield, Darien, New Canaan, New Fairfield, Norwalk, Ridgefield, Sherman, Stamford, and Wilton. No traces of the gipsy moth were found in these towns.

Tabulated statistics covering all towns worked during the year are given on the following pages, with a county summary on page 215:

STATISTICS OF INFESTATIONS, 1925-1926

Towns	No. Infestations Found	No. Egg-clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae and Pupae Killed	No. Miles Roadway Scouted
Windham County:						
Brooklyn ..G	11	943	9	200	8	73
Eastford ..	59	1,407	29	1,383	0	48
Hampton ..	6	437	2	175	211	34
Killingly ..G	56	3,856	35	626	1,498	94
Plainfield ..G	6	653	4	100	2,052	94
Putnam ...G	30	863	26	534	325	47
Thompson..G	109	7,158	72	2,047	292	106
Woodstock G	24	5,848	17	586	527	78
	292	21,165	194	5,651	4,913	574
New London County:						
Colchester	2	266	2	875	145	5
Franklin	0	0	0	0	0	5
Groton	9	363	3	25	907	60
Ledyard	1	6	1	25	0	1
Norwich	2	20	1	100	84	53
Old Lyme ...	0	0	0	0	0	25
Waterford ..	1	1	0	0	0	69
	15	656	7	1,025	1,136	218

G, work done by Federal men.

Towns	No. Infestations Found	No. Egg-clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae and Pupae Killed	No. Miles Roadway Scouted
Tolland County:						
Andover	0	0	0	0	0	6
Bolton	0	0	0	0	0	7
Columbia ...	3	920	3	225	230	2
Coventry	0	0	0	0	0	11
Ellington ...	5	25	0	0	114	29
Hebron	0	0	0	0	0	13
Stafford ...G	10	228	7	273	746	44
Tolland	1	5	1	75	0	17
Vernon	0	0	0	0	0	3
	19	1,178	11	573	1,090	132
Hartford County:						
Avon	0	0	0	0	0	61
Bloomfield ..	2	11	1	150	6	77
Bristol	0	0	0	0	0	50
Burlington ..	3	53	1	250	0	86
Canton	4	1,342	4	725	54	73
East Granby..	3	42	0	0	34	38
East Hartford	3	677	3	225	0	64
East Windsor	0	0	0	0	0	15
Farmington ..	1	11	1	50	0	55
Glastonbury..	2	2	0	0	0	38
Granby	20	1,932	12	2,850	1,106	94
Hartford ...	8	1,151	6	1,512	35	171
Hartland	13	380	5	550	149	66
Manchester ..	0	0	0	0	0	88
New Britain..	2	121	2	125	199	56
Newington ..	0	0	0	0	0	23
Plainville ...	0	0	0	0	0	32
Rocky Hill ..	0	0	0	0	0	32
Simsbury ...	6	166	2	437	3	85
South Windsor	0	0	0	0	0	17
Suffield	13	122	4	150	568	85
West Hartford	3	364	1	225	0	100
Wethersfield..	0	0	0	0	0	28
Windsor	1	2	0	0	0	64
Windsor Locks	0	0	0	0	0	32
	84	6,376	42	7,249	2,154	1,530
Middlesex County:						
Cromwell ...	0	0	0	0	0	54
Durham	0	0	0	0	0	61
East Hampton	0	0	0	0	0	81
Middlefield ..	0	0	0	0	0	54
	0	0	0	0	0	250
New Haven County:						
Bethany ....G	0	0	0	0	0	62
Cheshire ....G	0	0	0	0	0	93
East Haven..G	0	0	0	0	0	40
Hamden ....G	0	0	0	0	0	105
Meriden	2	14	1	275	0	129

G, work done by Federal men.

Towns	No. Infestations Found	No. Egg-clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae and Pupae Killed	No. Miles Roadway Scouted
New Haven County—*cont.*						
Middlebury..G	0	0	0	0	0	61
Naugatuck..G	0	0	0	0	0	60
New Haven..G	0	0	0	0	0	187
Orange .....G	0	0	0	0	0	51
Prospect ...G	0	0	0	0	0	41
Wallingford G	0	0	0	0	0	136
Waterbury ..	0	0	0	0	0	125
Wolcott	3	1,016	3	275	0	60
Woodbridge G	0	0	0	0	0	54
	5	1,030	4	550	0	1,204
Litchfield County:						
Barkhamsted	10	827	5	1,200	19	99
Bethlehem ..G	0	0	0	0	0	50
Bridgewater G	0	0	0	0	0	50
Canaan .....G	0	0	0	0	0	60
Colebrook ..	5	28	2	200	106	74
Cornwall ...G	0	0	0	0	0	107
Goshen .....G	0	0	0	0	0	99
Harwinton ..	1	414	1	775	0	111
Kent .....G	0	0	0	0	0	92
Litchfield ...G	0	0	0	0	0	140
Morris .....G	0	0	0	0	0	51
New Milford G	0	0	0	0	0	172
New Hartford	2	117	2	200	0	96
Norfolk ....G	3	57	1	50	0	90
North Canaan G	1	6	0	0	0	55
Plymouth ...	1	5	1	100	0	84
Roxbury ...G	0	0	0	0	0	73
Salisbury ...G	0	0	0	0	0	113
Sharon .....G	0	0	0	0	0	143
Torrington ..	0	0	0	0	0	128
Warren ....G	0	0	0	0	0	62
Washington G	0	0	0	0	0	105
Watertown..G	0	0	0	0	0	87
Winchester ..	0	0	0	0	0	13
Woodbury ..G	0	0	0	0	0	103
	23	1,454	12	2,525	125	2,257
Fairfield County:						
Brookfield ..G	0	0	0	0	0	68
Darien .....G	0	0	0	0	0	49
Greenwich ..G	1	328	1	1,175	0	143
New Canaan G	0	0	0	0	0	71
New Fairfield G	0	0	0	0	0	52
Norwalk ...G	0	0	0	0	0	105
Ridgefield ..G	0	0	0	0	0	95
Sherman ...G	0	0	0	0	0	49
Stamford ...G	0	0	0	0	0	125
Wilton .....G	0	0	0	0	0	75
	1	328	1	1,175	0	832

G, work done by Federal men.

SUMMARY OF STATISTICS

County	No. Towns Covered	No. Infestations Found	No. Egg-clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae and Pupae Killed	No. Miles Roadway Scouted
Windham	8	292	21,165	194	5,651	4,913	574
New London	7	15	656	7	1,025	1,136	218
Tolland	9	19	1,178	11	573	1,090	132
Hartford	25	84	6,376	42	7,249	2,154	1,530
Middlesex	4	0	0	0	0	0	250
New Haven	14	5	1,030	4	550	0	1,204
Litchfield	25	23	1,454	12	2,525	125	2,257
Fairfield	10	1	328	1	1,175	0	832
	102	439	32,187	271	18,748	9,418	6,997

Parasites

For many years the Federal Bureau of Entomology has had men in various foreign countries where the gipsy moth occurs, and all parasites discovered have been introduced into the United States. Altogether, some three dozen species attacking the gipsy and brown-tail moths have been brought into this country and reared at the Gipsy Moth Parasite Laboratory at Melrose Highlands, Mass. Most of them have been liberated somewhere within the infested area. Some of them have never been recovered, but certain species have withstood our New England winters, and have not only been recovered but have spread some distance from the points where liberated. About a dozen species of parasites of the gipsy and brown-tail moths have apparently become acclimated, and their combined attacks have undoubtedly checked the gipsy moth in many localities. A somewhat detailed account of these parasites was given in the Report of this Station for 1922, pages 314-317, and need not be repeated here. The species and number of individuals of each liberated each year in Connecticut since then have been published in the Reports as follows:

1923, page 265; 1924, page 271; 1925, page 271.

During the period covered by the present Report, only one species (*Anastatus bifasciatus*) was liberated in Connecticut. The number of individuals liberated in each of the towns where placed (a total of 400,000) is given in the following table:

Colebrook	5,000
Plymouth	2,000
Wolcott	9,000
New Britain	10,000
New Hartford	10,000
Burlington	9,000
Harwinton	10,000
Canton	43,000
Barkhamsted	60,000
East Hartford	3,000
West Hartford	5,000

Bloomfield	2,000
Simsbury	14,000
Stafford	9,000
Killingly	21,000
Suffield	6,000
Granby	82,000
Hartland	35,000
Hampton	41,000
Eastford	24,000
	400,000

The Gipsy Moth Quarantine*

(Revision Effective September 20, 1926)

From time to time it is necessary to revise the gipsy moth quarantine to meet changing conditions and to bring it into

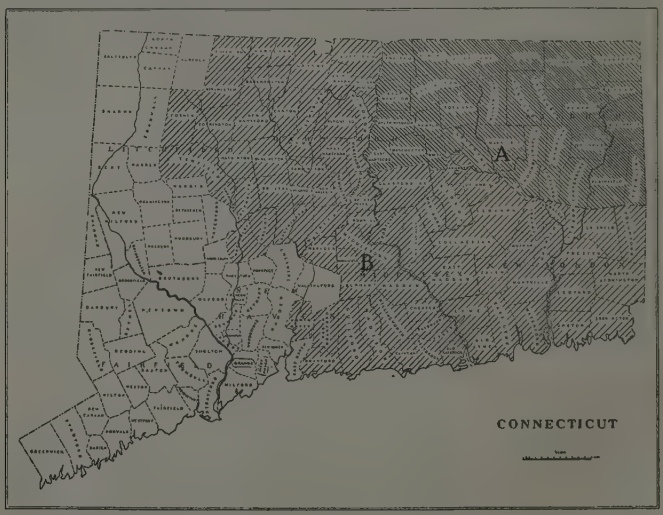

Fig. 1. Map of Connecticut; shaded area quarantined on account of the gipsy moth; (A) Generally infested; (B) Lightly infested.

harmony with the Federal quarantine. The Federal Horticultural Board of the United States Department of Agriculture has recently revised the Federal quarantine relating to the gipsy and brown-tail moths (effective July 1, 1926). The authority for establishing quarantines in Connecticut (Section 2106 of the

* Published as Bulletin of Immediate Information No. 54, October 1, 1926.

General Statutes) was amended by the last General Assembly, Chapter 107, Public Acts of 1925, so that stone, quarry products, and other materials liable to carry dangerous pests may now be included instead of plant products only.

After due notice, a public hearing was held in Hartford on September 9, 1926, and the subject discussed. There was no opposition expressed. The preceding quarantine order relating to the gipsy moth became effective July 20, 1924. Seven towns then placed under quarantine are now released by the present order, namely: Salisbury, Canaan, North Canaan, Norfolk, Cornwall, Cheshire and Wallingford. The two areas (A) and (B) are shown on the accompanying map, and the quarantine order follows:

STATE OF CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

QUARANTINE ORDER NO. 9

CONCERNING GIPSY MOTHS

Inasmuch as it is necessary from time to time to revise the quarantine regulations, to protect the uninfested parts of Connecticut from danger of infestation by the Gipsy Moth, and as the Federal Horticultural Board has made such revision, effective July 1, 1926, and shown on a map published by the United States Department of Agriculture, whereon two areas are designated: (1) a generally infested area, colored red, and (2) a lightly infested area, colored green; by authority given in Chapter 107, Public Acts of 1925, I do hereby proclaim the same areas to be under State quarantine, as follows:

GENERALLY INFESTED AREA (A)

WINDHAM COUNTY:

All of the fifteen towns as follows:

Ashford	Hampton	Scotland
Brooklyn	Killingly	Sterling
Canterbury	Plainfield	Thompson
Chaplin	Pomfret	Windham
Eastford	Putnam	Woodstock

TOLLAND COUNTY:

The ten northernmost towns as follows:

Bolton	Somers	Union
Coventry	Stafford	Vernon
Ellington	Tolland	Willington
Mansfield		

HARTFORD COUNTY:

Five towns east of the Connecticut River as follows:

East Hartford	Enfield	South Windsor
East Windsor	Manchester	

LIGHTLY INFESTED AREA (B)

NEW LONDON COUNTY:

All of the twenty-one towns as follows:

Bozrah	Ledyard	Old Lyme
Colchester	Lisbon	Preston
East Lyme	Lyme	Salem
Franklin	Montville	Sprague
Griswold	New London	Stonington
Groton	North Stonington	Voluntown
Lebanon	Norwich	Waterford

MIDDLESEX COUNTY:

All of the fifteen towns as follows:

Chester	East Hampton	Middletown
Clinton	Essex	Old Saybrook
Cromwell	Haddam	Portland
Durham	Killingworth	Saybrook
East Haddam	Middlefield	Westbrook

NEW HAVEN COUNTY:

Seven towns as follows:

Branford	Meriden	Waterbury
Guilford	North Branford	Wolcott
Madison	North Haven	

TOLLAND COUNTY:

Three towns as follows:

Andover	Hebron	Columbia

HARTFORD COUNTY:

Twenty-four towns as follows:

Avon	Glastonbury	Rocky Hill
Berlin	Granby	Simsbury
Bloomfield	Hartford	Southington
Bristol	Hartland	Suffield
Burlington	Marlborough	West Hartford
Canton	New Britain	Wethersfield
East Granby	Newington	Windsor
Farmington	Plainville	Windsor Locks

LITCHFIELD COUNTY:

Ten towns as follows:

Barkhamsted	Litchfield	Thomaston
Colebrook	New Hartford	Torrington
Goshen	Plymouth	Winchester
Harwinton		

1. It shall therefore be unlawful to remove any woody nursery stock, trees, shrubs, lumber, cordwood, telegraph or telephone poles, railroad ties, Christmas trees, "Christmas greens," tree branches for decoration, or other forest plant products, or stone or quarry products, or any material likely to carry the gipsy moth, from the generally infested to the lightly infested area, or from either infested area to the non-infested area of the State, except under certificates or permits issued by authorized State or Federal inspectors.

2. In view of possible future changes in the lines between the generally infested, lightly infested, and non-infested areas of the State, the areas quarantined by the State shall conform to those quarantined by the Federal Horticultural Board of the United States Department of Agriculture; furthermore, the Federal regulations covering interstate shipments of materials cited in Section 1 are hereby adopted for the regulation of shipments within the State of Connecticut.

3. This order shall take effect from its date.

Dated September 20, 1926.

W. L. Slate, Jr., *Director,*
Connecticut Agricultural Experiment Station.

Approved:

John H. Trumbull,
Governor.

It will be seen that the present quarantine involves fewer towns than the preceding quarantine (Quarantine Order No. 6) and that it follows the Federal quarantine in dividing Connecticut territory into two parts (A), generally infested, and (B), lightly infested, these areas being colored red and green respectively on the Federal map. It also differs from Quarantine Order No. 6 in that it includes stone, quarry products, and any other materials liable to carry the gipsy moth.

MATERIALS AND PRODUCTS REQUIRING INSPECTION

The materials requiring inspection under both Federal and State quarantines may be roughly divided into four classes as follows:

1. **Christmas Greens and Decorations**:—Coniferous trees, such as spruce, hemlock, fir, pine, juniper or red cedar, arbor vitae or white cedar, or foliage thereof, and decorative plants such as holly and laurel or parts thereof known and described as Christmas greens or greenery.

Movement of materials in this class originating in the generally infested area (A) may be moved within the area without inspection, but will not be allowed to points outside of the area. If originating in the lightly infested area (B), they may be moved to other points in the same area or to points in the generally infested area (A) without inspection, but cannot be shipped outside the quarantined area without a Federal certificate or permit.

2. **Nursery Stock**:—Trees, shrubs, vines, cuttings, and florists' stock if woody and field-grown, but not including florists' greenhouse-grown stock or herbaceous plants.

Nursery stock grown within the generally infested area (A) may be moved within the area without inspection, but in order to move it to points within the area lightly infested (B) or to points

outside the quarantine limits it must be accompanied by a certificate of inspection or permit issued by the United States Department of Agriculture. From points in the lightly infested area (B) plants may be moved to other points in the same area or to points in the generally infested area (A) without inspection; to points outside the quarantined area a Federal certificate or permit is necessary. Regular nurseries must hold State inspection certificates or this Federal inspection may be refused.

3. **Forest Products**:—Logs, poles, posts, ties, car stakes, cordwood, lumber, tanbark, etc., but not including square-edged lumber direct from the saw, or lumber direct from the mills and finished on all faces, boxes, shooks, staves, etc., which have not been exposed to infestation by piling or storing out of doors.

Forest products may be moved between points within the generally infested area (A) and from points in the lightly infested area (B) to points within both areas without inspection; but must bear Federal certificates or permits if moved from within the generally infested area (A) into the lightly infested area (B) or from either area to points outside the quarantine limits.

4. **Stone and Quarry Products**:—Field stone, paving, building or monumental stone, etc., brick, tile, drain or sewer pipe.

Such materials may move between points in the same area or from points in the lightly infested area (B) to points in the generally infested area (A) without inspection; but from the generally infested area (A) to points in the lightly infested area (B) or from points in both areas to points outside the quarantine limits, they must be accompanied by Federal certificates or permits.

It is understood that most of these inspections will be made by Federal inspectors, but State inspectors are also qualified to make inspections and issue certificates. Each frequent shipper should procure a Federal map showing these areas in colors, and learn the name, address, and telephone number of the Federal inspector detailed to cover his locality. The Federal inspection service is in charge of

J. N. Summers, 408 Atlantic Avenue, Boston, Mass.

to whom applications for maps and inspections should be made.

The State inspection service is in charge of W. E. Britton, Agricultural Experiment Station, New Haven, Conn.

Barrier Zone

Some three or four years ago it was suggested that for the protection of New York and other states westward a barrier strip or zone be established, in and beyond which the gipsy moth

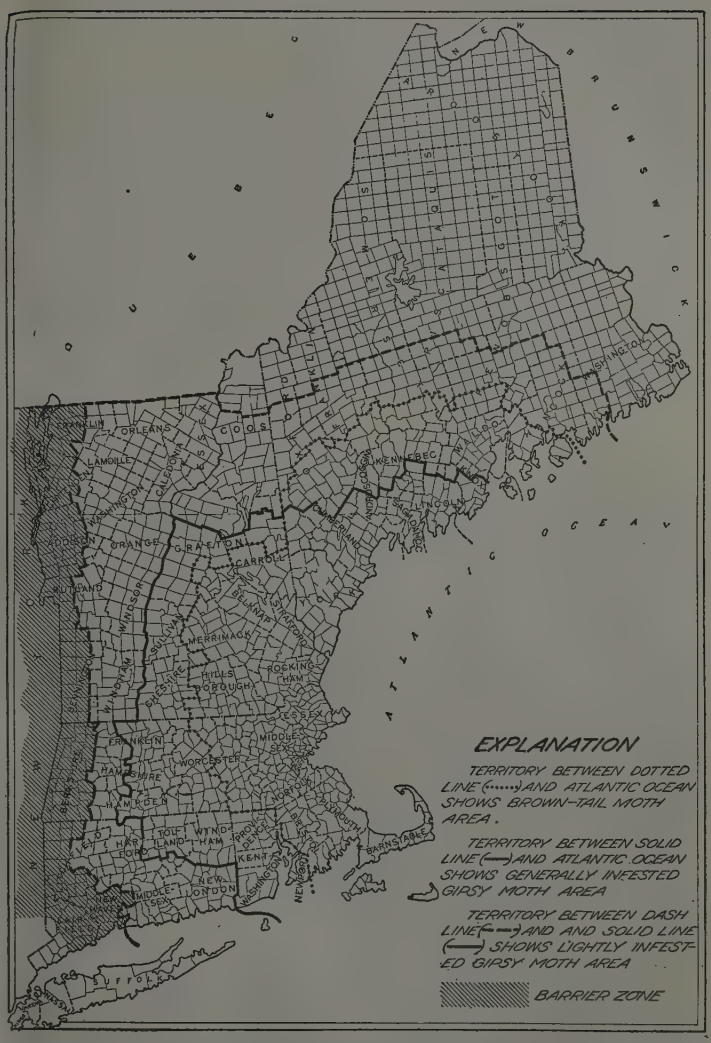

FIG. 2. Map of the New England States showing barrier zone, and generally and lightly infested gipsy moth areas (After Federal Horticultural Board, U. S. Dept. of Agriculture).

should not be allowed to gain a foothold. This idea was subsequently carried out, and extraordinarily thorough scouting has been done in this area each year by Federal and New York State men. Of course some infestations have started in this area, as well as west of it, but if taken in season they can be eradicated. This plan is now being followed and seems to be a sensible one. Had such an area or zone along the Connecticut River been established several years ago, the general infestation of a large area in western New England might possibly have been prevented. The barrier zone extends from the Canadian border southward to Long Island Sound. It includes Lake Champlain, which is a natural barrier, and a strip 25 to 30 miles in width between the Hudson River and the western boundary of New England, but, on reaching the highlands, this zone curves eastward, crossing Connecticut diagonally from the upper portion of Fairfield County to New Haven, as shown in figure 2.

Recommendations

Ever since the extensive wind-spread of 1920-21, funds have not been sufficient to scout the roadsides, orchards, and open fields over the entire area in any one year. The present plan of operation is to cover it in a two-year rotation, a procedure which might be fairly satisfactory if we could be certain of no wind-spread, and that the pest is not increasing. But unless our men go over the entire infested area each season, we cannot learn exactly just what conditions are present. Consequently, on the plan of a two-year rotation, some of the colonies obtain a two-year start before we discover them, and require a proportionately greater amount of work to eradicate them. Even greater is the danger in case a colony starts in a woodland some distance back from a highway or from the margin of the wooded area. Funds have never been sufficient to scout all woodlands in a systematic manner. Occasionally woodland infestations are discovered by accident, but otherwise they may gain considerable headway before their presence is discovered. The longer such colonies exist before being discovered, the more firmly do they become established, and the greater is the difficulty in eradicating them.

Even though seven towns have been released from quarantine, they must still be examined, and probably will be scouted by Federal men. Notwithstanding this, and even with the two-year rotation plan, there is a large area to go over each year, and the appropriation of $100,000 for the biennial period ending June 30, 1927, has not been adequate to do the work necessary to control this pest. We therefore respectfully recommend an appropriation of $120,000 for the biennial period ending June 30, 1929.

THE SPRUCE GALL APHID (*Adelges abietis* L.) AND ITS CONTROL

R. B. Friend

The spruce gall aphid is sometimes a serious pest in nurseries as well as in forest and ornamental plantings, and for this reason experiments were carried on in the spring of 1926 to determine the effectiveness of certain common insecticides in controlling it. In recent years this species has been known as *Chermes abietis* L., but the term *Chermes* is considered to be more properly used in connection with the jumping plant lice, the Chermidae, and the older name for the spruce gall aphid, *Adelges abietis* L., is coming back into favor.

The writer is indebted to Professor R. C. Hawley, consulting forester for the New Haven Water Company, for permission to use a plantation of this Company in these experiments.

Appearance and Life History

This insect causes the formation of galls on the twigs of spruces, and the number of galls found on one tree is sometimes enormous. Miss Patch (1909) reports the occurrence of 990 fresh galls on a white spruce tree three feet tall. The writer made observations in 1926 on an infestation in a plantation of Norway spruce near New Haven. Over a considerable part of the plantation 30 per cent of the trees were badly infested, and some bore several hundred galls, not all of them fresh. When the gall completely encircles the twig, the latter is killed. The twig always grows beyond the gall in the spring, but its growth is retarded, and in the fall it dies. Twig a, on plate IV, shows such a condition. Leaders are often attacked, and the killing of the leader retards the growth of the tree. The killing of both leaders and laterals may develop bushy trees but on account of the dead twigs, a heavily infested tree always looks unhealthy and weak. If the gall does not completely encircle the twig, the latter may live, although distorted in shape and retarded in growth, and finally slough the gall. On plate IV, b, may be seen two galls that did not kill the twig; c plainly shows the typical distortion of the twig and condition of the gall after about four years, and d shows the scar left by a gall which has been sloughed. The healing of the gall injury is similar in appearance to the healing of a wound. Plate V shows a young Norway spruce about seven feet tall with typical gall injury. The leader and most of the tips of the upper laterals have been killed. In the Norway spruce plantation above referred to, a large number of gall-bearing twigs were examined on five trees taken at random and the per cent of dead

twigs calculated. Of 852 gall-bearing twigs examined, 132 were alive and 720 were dead, a mortality of 84.5 per cent of the twigs infested. This represents a serious condition as regards the growth of the tree and its appearance. In this plantation most of the injury was found on trees under ten feet in height. Where the trees were thickly planted, most of the galls were confined to the upper branches, but in more open planting the galls were on all parts of the tree. The number of fresh galls on a tree sometimes increases with the duration of the infestation until practically every twig is infested. Although many of the trees infested were seriously injured and worthless for any future use, in none of the observed cases had death occurred due to galls alone. Herrick and Tanaka (1926) report the death of spruces in hedges as due mainly to the attack of this aphid.

In the United States the principal hosts are Norway spruce (*Picea excelsa*), and white spruce (*P. canadensis*). Britton (1924) reports the presence of galls on red spruce, black spruce, and occasionally hemlock. The galls found on the Colorado blue spruce are caused by a different species, *Gillettea cooleyi* Gill. This latter species makes a large gall on the tip of the twig, whereas the gall of *Adelges abietis* is smaller and is always at the base of the twig. The habits of the two species also differ in that *Gillettea cooleyi* spends part of its life cycle on the leaves of the Douglas fir but does not form galls on this tree. On plate VI, is shown the form on Douglas fir and that on Colorado blue spruce. On the Sitka spruce this is also a serious pest. Although it is a generation in the life cycle of *Gillettea cooleyi,* the form on Douglas fir is known as *Gillettea cooleyi* var. *coweni* Gill. Control measures are the same as for *Adelges abietis.*

The life history has been worked out by Fernald and Cooley (1898) and by Herrick and Tanaka (1926), and these authors may be consulted for a detailed study. Only those facts bearing on control will be mentioned here. The young wingless females hibernate on the under side of the spruce twigs close to the buds. They are at this time about 0.4 mm. in length and a dark slaty gray in color. The presence of a few white waxy threads secreted by the insect gives it a slightly woolly appearance. The last of April the young females molt and become sexually mature. The woolly appearance becomes accentuated by an increased secretion of white waxy threads which cover the insect and eggs completely. On plate III, a, center, part of the waxy covering has been removed to show the eggs; right view is normal. The period of oviposition seems to coincide with the breaking open of the spruce buds and occurs during the first and second weeks of May. Each female lays about 100-200 eggs, and these hatch in about one week. By this time the young needles have appeared on the twigs, and the newly hatched young crawl to the bases of the new needles

and attach themselves permanently. Although it has been claimed that the gall is started by the feeding of the hibernating female, certainly no gall develops unless the young feed on the needles. The irritation brought about by the feeding of the young causes the bases of the needles to swell until they touch each other. The final result is one continuous gall with the young aphids enclosed in pockets inside. These galls break open in August, and the fully grown nymphs come out and crawl to the needles. They molt once and transform to sexually mature winged females which lay eggs on the needles, about 40-50 eggs per female, and from these in about two weeks the overwintering forms hatch. After wandering about a short time, these hibernating females settle on the twigs for the winter. Plate III, a, at left, shows the young on the twigs, but the photograph does not represent the typical location, for the insects tend to cluster about the bases of the buds. There is a very heavy winter mortality, comparatively a small per cent of the overwintering nymphs surviving. However, the survival of one young female at the base of a bud is sufficient to cause the formation of a gall in the spring. To the best of our knowledge there are no males of this species, all reproduction being parthenogenetic.

Control

Laboratory tests with various insecticides were made by dipping Norway spruce twigs bearing hibernating nymphs in the insecticide for an instant. The twigs were examined 24 hours later. These tests were carried on the last week in March, 1926, and the results are indicated in the following table:

Laboratory Tests

Insecticide	Dilution	Per cent dead
Carbolic acid emulsion	1-15	96
	1-20	100
	1-25	100
Kerosene emulsion	1-25	100
	1-30	100
	1-35	100
Nicotine sulphate (40%)	1-800 (+ soap)	100
Scalecide	1-30	100
Sunoco	1-25	100
	1-30	100
	1-35	100
Volck (80% oil)	1-25	100
Whale oil soap	1 lb. in 10 gals.	96
	1 " " 7.5 "	100
	1 " " 5 "	100
Check—water		none
Check—no treatment		none

The nicotine sulphate contained enough whale oil soap to make 0.5% of the weight of the diluted material. Three to five twigs were used in each trial, each bearing 10-25 live aphids.

On the basis of these tests, field spraying experiments were made on Norway spruce trees during the first part of April, 1926. The trees were from three to eight feet high and were all heavily infested with galls. Three trees were sprayed with each insecticide. Six days after the first application the trees were examined, and some of the treatments were apparently not as effective as was desired. Stronger sprays of the same material were then applied to one or two of the three trees previously treated and to one additional tree not previously treated. The sprayed trees thus fall into three groups: (1) receiving one application of the weaker spray; (2) receiving two applications, one of the weaker, and one of the stronger spray; (3) receiving one application of the stronger spray. Six trees were kept untreated as controls. The trees were all examined at intervals for nine months after spraying, and no injury to foliage was detected that could be attributed to the insecticide. Not all the materials tested in the laboratory were applied in the field. The following table gives those that were used.

FIELD APPLICATIONS

Insecticide	Dilution	Applied	Trees	Galls developed
Carbolic acid emulsion..	1-20	April 3	2	22
	1-20	" 3	1	none
	1-20	" 16		
	1-20	" 16	1	12
Nicotine sulphate (Black Leaf 40)	1-800 + 0.5% soap	" 3	2	75
	1-800 + 0.5% "	" 3	1	3
	1-500 + 0.7% "	" 16		
	1-500 + 0.7% "	" 16	1	none
Scalecide	1-30	" 3	1	none
	1-30	" 3	2	none
	1-30	" 16		
	1-30	" 16	1	none
Sunoco oil	1-35	" 3	1	30
	1-35	" 3	2	none
	1-25	" 16		
	1-25	" 16	1	none
Whale oil soap	1 lb. in 8 gals.	" 3	1	none
	1 lb. " 8 "	" 3	2	1
	1 lb. " 5 "	" 16		
	1 lb. " 5 "	" 16	1	none
Control trees	No treatment			100-200 per tree

The number of infested twigs per tree was not determined before the sprays were applied, so no percentages are given as regards control. The carbolic acid emulsion gave indefinite

results. The three galls found on the tree receiving two applications of nicotine sulphate, and the one gall found on the tree receiving two applications of whale oil soap were probably due to missing the twigs in the spraying operation. The soap was added to the nicotine sulphate to act as a spreader, and the amount given is per cent of the diluted spray as applied. Nicotine sulphate diluted 1 to 500, Scalecide diluted 1 to 30, and Sunoco oil diluted 1 to 25 gave excellent results with one application. Other miscible oils and oil emulsions would probably give just as good control if diluted to the same relative strength. If spruce mites are present on the trees, the miscible oils are preferable, as they control mites as well as aphids.

Dr. Garman of this Station sprayed some spruce trees in the same block with lime-sulphur (commercial, testing 32 degrees Baumé) diluted 1 to 16 and 1 to 40. No galls developed on the trees and the foliage was not injured. This insecticide adheres to the foliage for weeks and may be objectionable under some conditions for this reason. The trees were sprayed April 3. The 1 to 40 strength was just as effective as the 1 to 16.

The trees must be sprayed while dormant in order to obtain good results. If the trees are sprayed after the buds open, not only is there danger of foliage injury, but at this time the aphids are covered by a very thick coat of waxy threads which protects them from the insecticide. It is useless to spray after the galls are formed. The spray should be applied between the first of November and the middle of April, and the twigs must be thoroughly covered, especially on the under side. One good application of the insecticide will keep the trees free of galls for the season.

Experiments of Other Workers

For the detailed results of other workers in spraying for this aphid, the bibliography may be consulted. Fernald and Cooley (1898) recommend whale oil soap at the rate of 1 pound in 2 gallons of water. Herrick (1925) recommends miscible oils diluted 1 to 20, or powdered lime-sulphur at the rate of 16.5 pounds in 50 gallons of water, and Herrick and Tanaka (1926) obtained good results with lime-sulphur (32° Baumé) diluted 1 to 8. Britton (1924) states that spring or fall applications of miscible oils diluted 1 to 20 are effective and have caused no foliage injury when used several successive seasons. Bourne (1926) obtained excellent control with an oil emulsion (Volck) diluted 1 to 25, and with miscible oils diluted 1 to 25. These insecticides were used at slightly greater strengths than those used by the writer, and no injury to the trees resulted. However, for several reasons, the weakest *effective* spray is the best and should be used.

Recommendations

For the control of this insect it is recommended that the trees be sprayed *while dormant,* preferably during the first two weeks of April, with any one of the following materials:

Miscible oils diluted 1-25.
Whale-oil soap 1 pound in 8 gallons of water.
Nicotine sulphate, containing 40 per cent nicotine, diluted 1-500 plus soap (enough to make 0.5 per cent, by weight of the diluted spray).
Commercial lime-sulphur, testing 32 degrees Baumé, diluted 1-40.

The tips of the twigs must be thoroughly covered, particular attention being given to the under side.

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FURTHER REPORTS ON SPRAYING AND DUSTING OF APPLES

E. M. Stoddard and M. P. Zappe

This is the seventh report we have made on spraying and dusting experiments in Connecticut, and six of these have data on the orchard on which we are reporting this year. Besides the comparison of a complete spraying schedule with a complete dusting schedule, we have continued trials on the most promising combination treatments. These combination treatments have proven quite successful, and are being used in a number of commercial orchards.

The results of previous experiments made by this Station have been reported in the following Station publications: Entomologist's Report 1920, page 168; Bulletin 235; Bulletin 245; Entomologist's Reports for 1923, 1924, and 1925.

Orchard Under Experiment

The orchard of Mr. Frank N. Platt, in Milford on which experiments were started in 1921, was used in 1926. The trees in this orchard are 22 years old, growing in sod, and with nitrate of soda as a fertilizer, and are in good growing condition. The varieties used were Baldwin, Greening, Gravenstein and McIntosh.

Materials and Apparatus Used

The following materials were used in this experiment:

SPRAY

Dry Lime-sulphur	6 pounds
Lead Arsenate	3 pounds
Water	100 gallons

No nicotine was used in any of the treatments.

POMODUST

Sulphur	90 parts by weight
Lead Arsenate	10 " " "

KOLOTEX DUST

Sulphur	85 parts by weight
Lead Arsenate	15 " " "

This is a new dust manufactured by the Niagara Sprayer Co., after a new process which produces a very fine dust, which is more economical to use than coarser dust and is said to have excellent sticking qualities.

We have no data on the sticking qualities, but per unit of weight it seemed to cover more area than Pomodust with which it was compared.

A new Sulphur-Lead Arsenate Dust known as Naco Dust, put out by the Nitrate Agencies Co., was tried in a limited way, but not sufficiently to warrant making any comment on its physical properties, or its insecticidal or fungicidal value.

Arrangement of Plots

The orchard was divided into seven plots of two rows each running across all the varieties. One of these plots was a spray barrier to prevent dust blowing onto the check plot, and the data were not used in making comparisons.

The arrangement of plots and schedule of treatment are shown in the following table:

	No. 1 Pink May 11	No. 2 Calyx May 27	No. 3 1st after calyx June 9	No. 4 2d after calyx July 1
Plot 1	Spray	Spray	Spray	Spray
Plot 2	Pomodust	Pomodust	Pomodust	Pomodust
Plot 3	Kolotex Dust	Kolotex Dust	Kolotex Dust	Kolotex Dust
Plot 4	Spray	Spray	Pomodust	Pomodust
Plot 5	Spray	Pomodust	Pomodust	Spray
Plot 6	Check No treatment	Check No treatment	Check No treatment	Check No treatment

All varieties received the four applications.

Method of Recording Data

The data on the results of treatment were taken as in previous years, which in brief consisted of examining all the apples from selected trees in each plot, and recording the several injuries and perfect fruit on a series of tally registers arranged on a board so placed on the sorting table that each person scoring fruit could record his own data. This scoring device is described in detail on page 273 of the Entomologist's Report for 1925. A total of 275,968 apples were scored on the four varieties for all the treatments.

Results of Treatment on McIntosh

	Plot 1 Spray	Plot 2 Pomodust 00-10	Plot 3 Kolotex Dust 85-15	Plot 4 Spray 1, 2 Dust 3, 4	Plot 5 Spray 1, 4 Dust 2, 3	Plot 6 Check
Good	82.0	81.96	81.96	81.20	78.55	42.15
Aphis	5.44	8.13	11.06	10.62	12.72	12.38
Red bug	1.84	1.82	1.70	1.41	2.18	13.21
Codling moth	1.50	.32	.07	.04	.01	2.5
Curculio	3.68	1.78	1.59	1.38	1.74	23.06
Eulia	.5	.85	.79	.68	.58	1.67
Other chewing insects	5.91	4.71	3.06	3.81	3.57	6.22
Scab	.08	1.04	.35	1.51	1.35	23.99
Sooty blotch Fruit speck	0	0	0	0	0	0

Discussion of Results

It will be noted that all the treatments gave approximately the same percentage of good fruit. Scab infection on the treated plots was a negligible quantity and even on the check the per cent of infection was remarkably low. This was due to the lack of rain in May and a later development of the foliage than usual, so that the young leaves matured during a period of scant rainfall and low humidity. Judging from a series of experiments designed to show when infection occurred there was only one period of two days, May 14 and 15, when there was any appreciable amount of infection.

RESULTS OF TREATMENT ON GREENING

	Plot 1 Spray	Plot 2 Pomodust 90-10	Plot 3 Kolotex Dust 85-15	Plot 4 Spray 1, 2 Dust 3, 4	Plot 5 Spray 1, 4 Dust 2, 3	Plot 6 Check
Good	83.56	82.1	79.68	87.86	78.58	5.99
Aphis	10.73	9.67	12.96	4.2	10.57	12.94
Red bug	.38	.47	.15	.19	.21	11.3
Codling moth	.26	.1	.12	.12	.21	4.49
Curculio	2.47	2.06	2.22	2.12	3.3	60.68
Eulia	1.85	2.72	2.00	2.45	3.17	11.5
Other chewing insects	1.37	2.3	1.41	2.16	3.07	5.99
Scab	.08	.07	0	.09	.09	2.8
Sooty blotch	.20	.58	1.11	.23	.38	22.65
Fruit speck	.05	.28	.84	.4	.42	20.29

DISCUSSION OF RESULTS

With this variety we note a difference in the value of the treatments judging by the per cent of good fruit. In Plot 4 the higher per cent of perfect fruit is explained by the marked decrease in aphis infection which is unaccounted for, as there were no control treatments for aphis used. In Plot 5 the decrease of good fruit is due to a slight increase in curculio, Eulia and other chewing insects. All treatments showed good control of red bug, which must have been due to repellent action of the materials, as no nicotine was used. This variety showed more Eulia damage than did the other varieties; also sooty blotch, fruit speck and curculio showed higher percentages of injury on the check plot, but were well controlled on all the treated plots.

RESULTS OF TREATMENT ON GRAVENSTEIN

	Plot 1 Spray	Plot 2 Pomodust 90-10	Plot 3 Kolotex Dust 85-15	Plot 4 Spray 1, 2 Dust 3, 4	Plot 5 Spray 1, 4 Dust 2, 3	Plot 6 Check
Good	80.1	79.4	70.84	86.42	77.3	17.67
Aphis	15.96	15.07	21.78	10.06	18.31	35.55
Red bug	1.22	.96	.78	1.0	.99	13.85
Codling moth	.12	.12	.07	.14	.04	1.97
Curculio	1.32	2.03	4.49	.74	1.61	48.58
Eulia	.49	.96	.71	.46	.75	1.61
Other chewing insects	1.26	1.74	1.72	.10	1.47	8.87
Scab	.08	.31	.27	.15	.24	2.41
Sooty blotch	.04	.37	.09	.52	.16	.4
Fruit speck	0	0	0	0	0	0

Discussion of Results

Plot 4 showed an appreciably higher per cent of good fruit which can be accounted for by reduction of the damage by curculio and other chewing insects and a decrease in aphis injury. This variety had the heaviest infestation of aphis of any of the varieties on both treated and untreated plots, a usual and expected condition.

Result of Treatment on Baldwin

	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6
	Spray	Pomodust 90-10	Kolotex Dust 85-15	Spray 1, 2 Dust 3, 4	Spray 1, 4 Dust 2, 3	Check
Good	87.38	88.43	95.89	90.94	87.3	14.12
Aphis	9.98	3.87	4.2	4.38	5.99	4.66
Red bug	.74	.16	.09	.08	.16	2.66
Codling moth	.26	.27	.23	.14	.09	4.3
Curculio	.88	2.63	1.49	1.15	1.57	48.84
Eulia	.42	1.5	1.05	.9	1.84	4.06
Other chewing insects	.94	3.44	2.28	2.58	3.39	41.15
Scab	0	0	0	0	0	0
Sooty blotch Fruit speck	0	0	0	0	0	8.66

On this variety the treatments on Plots 3 and 4 gave the highest per cent of good fruit which was mostly due to the lesser amount of aphis infestation. It will be noted that spraying controlled codling moth, Eulia and other chewing insects better than any other treatment. Scab was not present on this variety at all, and fruit speck and sooty blotch occurred only on the check plot. We do not account for the very high percentage of injury by other chewing insects on the check plot, and the insect causing this injury was not determined. It evidently occurred early in the season and may have been caused by canker worms.

Summary and Comment

As a method of comparison of the relative value of the different treatments we present the following table. In this table the varieties are arranged opposite the several injuries under the treatment which gave the best control, and in the case of good fruit under the treatment giving the highest percentage, e. g., our data show that curculio was best controlled on Baldwin by spraying, this being indicated in the table by the letter B under "Spray" and opposite "Curculio." If several treatments gave the same control the variety is listed under each one.

	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
Good	M		B	G Gr	
Aphis	M	B		G Gr	
Red bug			G Gr	B M	
Codling moth		Gr			B G M
Curculio	B	Gr		G M	
Eulia	B M Gr			G	
Other chewing insects	B Gr		M	G	
Scab	B G M	B	B Gr	B	B
Sooty blotch	B G M Gr	B M	B M	B M	B M
Fruit speck	B G M Gr	B G M	B G M	B G M	B G M
Total score	19	9	11	16	9

B—Baldwin. M—McIntosh. G—Gravenstein. Gr—Greening.

From this comparison we find spraying to have three points more to its credit than its nearest competitor, which was the combination treatment on Plot 4. This result tallies with the results obtained in 1925 and further confirms our belief that spraying is necessary, in the early treatments at least, to ensure a high per cent of perfect fruit. The failure of the combination on Plot 4 was due to lack of control of sooty blotch and fruit speck on Greening and Gravenstein, and this we believe is its weak point and would necessitate the substitution of spraying for the last dust treatment in a year of abundant rainfall in the latter part of the summer. Dusting did not give as good results compared with spraying as it did in 1925, which seems to be accounted for by lack of control of curculio, Eulia and other chewing insects.

It will be noted that only four treatments were given this year, the pre-pink and last summer treatment being omitted on all varieties. The pre-pink was deemed unnecessary on the McIntosh because of the dry weather prevailing at the time it would have ordinarily been applied. There did not seem to be any real need of the last summer treatment as weather conditions did not presage a serious infection of sooty blotch and fruit speck. A scarcity of insects made treatment for their control unnecessary. This forecast proved correct except in the case of Greenings, where a light infection of sooty blotch and fruit speck developed following eight days of rain in August, which infection might have been controlled by an extra treatment in the early part of August. Other than this our data do not show that there was lack of control of any pest more than is normally expected.

Among the insect pests curculios and aphis caused the largest amount of damage, but the curculios were well controlled by all treatments, and the aphis did no real damage except on Gravenstein, and perhaps here they were a blessing in disguise, as the trees were so heavily set with fruit that the 15-20 per cent of aphis apples took the place of thinning which the trees did not have.

ACKNOWLEDGMENTS

The writers are indebted to Mr. Frank N. Platt for the use of the orchard, power sprayer and assistance in conducting the experiments, also to Messrs. B. H. Walden, J. L. Rogers, and A. D. McDonnell who assisted in scoring the fruit at harvest time. We also wish to acknowledge the assistance rendered by Dr. Florence A. McCormick in examining scab material.

WORK WITH THE ORIENTAL PEACH MOTH IN 1926

PHILIP GARMAN

1. **Distribution.** The present distribution of the Oriental peach moth in Connecticut remains much the same as reported two years ago except for the fact that the population seems to be increasing in density in Fairfield and New Haven Counties. An infestation of considerable severity was observed on the Massachusetts line, and it has been reported from nurseries in the vicinity of Storrs. Outside the State the pest has now been reported from New York, New Jersey, Delaware, Maryland, Virginia, Pennsylvania, North and South Carolina, Florida, Alabama, Texas, Arkansas, Missouri, Georgia, Tennessee, Ohio, Indiana, and perhaps others. It has also been found in Ontario, Canada. So far it seems to be most destructive in New Jersey and Pennsylvania, although word has been received that the Canadian infestation is very severe. It seems probable, therefore, that the insect may extend its range northward in the eastern United States as far as peaches are grown.

2. **Life History Studies.** Three broods were evident this year, and there was no sign of a fourth as in 1925. Bait-pan records indicate three distinct periods of maximum abundance corresponding in general with life history studies made in the insectary. Four field cages placed over individual trees were maintained, and these also indicated a three-brooded condition for 1926. An interesting point in connection with field cage records is the increased length of time occupied by the later generations even if started from a few individuals placed in a cage on a given date early in the summer. Thus, in our cages where adults were liberated early in June or July, adults were continually present from the first week in August until the tenth of September. Records from bait pans indicate that moths are present in the orchard until the latter part of September, which means an even longer period of activity than occurred in field cages. For the last brood it appears that their flight extends from about the fifth of August until about September 25, and reaches its maximum abundance near the first of September.

3. Control Studies. Through the courtesy of the Barnes Nursery & Orchard Company of Wallingford, Conn., several plots of Elberta were made available for control studies. Bait pans were used as a means of control, the material employed as bait being diluted molasses (1 part in 20 parts water). The pans were refilled once a month and fresh molasses added about once a week. Pails of the sort used (two-quart tin pails) require almost constant attention to be kept in working order, since they dry out rapidly in dry weather, fill up and run over in wet weather, become choked with other species of moths during certain periods of fermentation, and if not fastened to a rigid part of the tree, will spill over with a slight wind. In addition to actual work in the orchard, a three-gallon enameled pail was provided with bait and hung in the center of one of our field cages. Eleven moths were then liberated in this cage. None were caught in the pail and the twigs and fruit became generally infested with larvae. Later two smaller pails were hung in the same tree, but placed higher than the large enameled pail just described. These pails caught a number of moths, but by no means all of them, and many eggs were laid within a few feet of the pails.

It seems difficult to reconcile these facts with field experience where large numbers of moths are caught daily, but the only choice we have is to reason that the total Oriental peach moth population in an orchard is very great, and that relatively few are caught by the pail method. However, should any degree of control be obtained in orchard practice, it would certainly be encouraging. Our results are shown in Table I and indicate no advantage from the use of pails over plots without pails. A decided change in our present methods of bait-pan control, therefore, seems to be desirable. It also appears that workers in Pennsylvania and New Jersey have not obtained satisfactory control, so we are still much at sea regarding control of the Oriental peach moth by this means.

In addition to bait-pan work, two plots were sprayed with special preparations consisting of (1) lime-fluoride-sulphur-casein, and (2) lime-lead-arsenate-sulphur-casein mixture followed by a thorough spray of nicotine sulphate in August. A continuous coating was maintained on the fruit from June until late in August, but in spite of this coat no substantial increase in sound fruit was obtained. The main part of the infestation seems to have come after August 25, or after much of the spray had disappeared from the fruit and foliage. Herein, it seems to me, lies one of the greatest difficulties in controlling the Oriental peach moth, at least by means of any known sprays.

It was noticed this year that there was much less of an infestation on the same trees than last year. What caused this reduction can only be surmised, but there are several things which undoubt-

edly helped bring it about. Cultivation and parasitism were important factors. A third, perhaps much less important, may be found in the cool, rainy period during the time when the third brood was at its height. Our score indicated 10% to 20% less wormy fruit than was encountered last year, which shows that certain agencies were at work reducing the number of insects in the orchard.

Parasites

The parasite *Trichogramma minuta* Riley was obtained from eggs of the Oriental peach moth at New Haven. A considerable number of eggs laid on quinces near the laboratory were found with parasites, but only one adult specimen was obtained. They were seen in August and September.

Table I. Record of Field Treatments for Control of the Oriental Peach Moth

Plot	Treatment	Picked fruit: Cut Fruit % Injured	Picked fruit: Uncut Fruit % Injured	Picked fruit: Total No. Cut Open	Picked fruit: No. Examined without Cutting
A	Pail in every tree.....	12.7	7.2	1,024	3,345
B	Pail in every other tree	9.7	5.8	1,370	5,791
C	Check—No pails	10.5	5.4	928	4,366
D	Fluoride, Lime, Sulphur, Casein-lime — 4 treatments	16.5	7.0	1,586	7,639
E	Lead Arsenate, Lime, Casein-lime—2 sprays; Lime, Casein-lime — 1 spray; Nicotine sulphate—1 spray	22.7	10.4	1,304	6,326
F	Check — Fungicide only	18.6	12.7	1,331	6,295

Notes.—Eight to ten count trees were selected in each plot and representative samples were examined from each. The variation in percentages of infested cut fruit from different trees is as follows:—(A) 4.9-20.2%, (B) 1.8-14.0%, (C) 3.2-19.6%, (D) 5.9-20.7%, (E) 5.6-34.2%, and (F) 8.2-33.3%. If thinnings are included in the count D and F average nearly the same, while E averages nearly four per cent higher than D and F. No thinnings were made on plots A, B, and C and the number of peaches per tree at picking time was greater than was found on D, E, and F. The plots were laid out so that the prevailing winds blew across them and not from one to another. In the sprayed plot the check (F) formed a figure H, the count trees being located in both uprights and crossbar while the sprayed plots D and E were located between the uprights and on either side of the crossbar. About 50 trees were used in each plot including those with bait pans, the trees being approximately the same size as those used in 1925 and shown in Bull. 275, Pl. VI, a. The spray materials used on D and E con-

sisted of a very large percentage of hydrated lime, 30 pounds per 100 gallons and the trees were fairly whitewashed with it. The original mixture also contained 20 per cent calcium fluoride. No injury could be seen except a slight burn from the early applications on E. D remained throughout the season without any sign of injury either in the form of dropped foliage or bark cankers. Dates of spray applications June 8, July 10, August 2, August 19.

Notes on the Feeding Habits of the Oriental Peach Moth with Special Reference to Artificial Foods

Since the Oriental peach moth larva has not been successfully poisoned by any insecticide in common use to-day, it was thought advisable to study artificial foods upon which the larva might be induced to feed and develop, with a view of incorporating some poison with whatever food might prove acceptable. With this in view, agar was first tried alone and as a medium for various sugars and acids but proved too soft. No combination stiff enough for the purpose could be made. Flour dough was next tried and it was observed immediately that the larvae would feed on this material. Consequently feeding tests were begun, mixing with the dough certain sugars, acids, and other compounds, and the following notes relate to this work. Pure flour dough was found to ferment too rapidly to be of much use, but mixtures containing citric and malic acid were more permanent, although even here the material became moldy, and it is probable that some of the difficulty encountered in carrying the larvae through a number of instars was due to this factor. It was noted in the course of the work that larvae would not feed much until they had dug into the food and had spun a thin web over the point of entrance. There was some difficulty at first in determining whether the larvae actually fed upon the materials offered, but it was soon found that the color of the excretory pellets is quite different when the insect is fed artificial food than when fed upon natural foods. It is also fairly easy to distinguish excrement from pellets taken in the mouth and then laid aside before beginning to feed. Plate XVI, b, shows a larval tunnel in one of the artificial mixtures described.

It will be seen from the following notes that while the insects did not develop naturally on any of the foods, in several cases they passed through complete instars and survived for as much as three weeks on the artificial media. Probably the most successful mixture used was No. 10, containing two acids and two sugars, but it may be possible to simplify and improve this so that still greater development will be apparent. Some success will be noted with several other combinations, but none of them is completely satisfactory in promoting growth in the Oriental peach moth larva.

(1) July 27. A mixture of flour, water, casein and malic acid (5%); four larvae used; all entered in 24 hours.

(2) July 28.

Flour	50 gm.
Casein	5 gm.
Water	35 cc.

Two larvae used; both entered and fed; a mixture of 50 gm. flour and 35 cc. water was also fed to three larvae.

(3) July 29.

Flour	50 gm.
Malic acid	5 gm.
Amygdalin	1 gm.
Water	35 cc.

The material was divided and larvae placed as follows: (1) two nearly full grown and one half grown, one larva spun July 30; (2) one two-thirds grown, three recently hatched; (3) one nearly full grown; (4) one about two-thirds grown and one very young—all larvae entered and fed inside of five hours.

(4) August 7.

Flour	50 gm.
Malic acid	2 gm.
Cane sugar	5 gm.
Peach leaf juice[1]	35 cc.

The material was divided as follows: (1) two half grown larvae were used but both were lost August 13; (2) two larvae, one of which was nearly mature; one of these spun August 16.

(5) August 17.

Flour	50 gm.
Dextrose	10 gm.
Malic acid	1 gm.
Peach leaf juice[1]	35 cc.

Three larvae were used. On August 18 two were found feeding and continued alive until August 23, when two larvae spun; one became sick on August 27 and was removed. One adult emerged September 9 and one September 12.

(6) August 24.

Flour	50 gm.
Dextrose	10 gm.
Citric acid	1 gm.
Malic acid	1 gm.
Water	38 cc.

One larva about two-thirds grown was introduced and fed readily on the material; continued alive until September 1 and spun on this date.

(7) August 24.

Flour	50 gm.
Dextrose	10 gm.
Citric acid	1 gm.
Malic acid	1 gm.
Dried peach leaf extract	38 cc.

Two larvae 5 to 7 mm. long were used; still alive August 30 and apparently nearly ready to spin September 2; lost after this day but a cast head capsule was found August 30 among the frass of the mixture.

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[1] Peach leaves macerated in water.

(8) September 1. Flour ..... 50 gm.
Citric acid ..... 1 gm.
Malic acid ..... 1 gm.
Cane sugar ..... 10 gm.
Water ..... 38 cc.

One larva used—width of head September 1, .33 mm.; molted September 3, width of head as near as could be determined .44 mm.; still alive September 9 but sick and stopped feeding.

(9) September 3. Flour ..... 50 gm.
Cane sugar ..... 10 gm.
(Certo) pectin ..... 40 cc.

Two larvae used in separate containers but neither of them fed.

(10) September 9. Flour ..... 50 gm.
Citric acid ..... 1 gm.
Malic acid ..... 1 gm.
Dextrose ..... 5 gm.
Amygdalin ..... 5 gm.
Water ..... 38 cc.

One larva used; width of head capsule .66 mm.; O. K. September 18; molted September 23; size of head capsule .77-.8 mm.; still O. K. September 29; molted October 4, head .99 mm. wide—observed shortly after molt on October 4; died about a week later.

(11) September 9. Flour ..... 50 gm.
Citric acid ..... 1 gm.
Malic acid ..... 1 gm.
Dextrose ..... 10 gm.
Benzaldehyde (1 drop in 100 cc.) ..... 38 cc.

One larva, head .66 mm. wide, was used; still alive on September 14 but not seen after that day.

(12) September 28. Flour ..... 50 gm.
Citric acid ..... 1 gm.
Malic acid ..... 1 gm.
Water ..... 38 cc.

One larva with head .5 mm. wide, length 5-6 mm.; molted September 30; still alive October 22 when head capsule measured .88 mm. in width; this was evidently the last instar, was considerably undersize, but pink in color.

EUROPEAN CORN BORER CLEAN-UP WORK IN 1926

W. E. Britton and M. P. Zappe

The fall work in cleaning up the 1925 European corn borer infestations was suspended late in December on account of inclement weather, and was described in the Report of this Station for 1925, page 303. The remaining clean-up work was done in the spring of 1926 and was all in the towns of Stonington and Groton, where 5,091 gallons of furnace oil were used in burning, and 97 man days of labor expended.

Corn stalks and weeds lose much of their moisture during the

winter months and consequently burn more readily in spring, and require much less oil per acre. Where there is considerable work to be done, however, it is hardly safe to leave it all until spring, because the season then comes on with a rush, labor is in greater demand, and the work may not be finished. It seems best, therefore, to do some of the burning in the fall, even if more difficult, and it precludes the possibility of infested material being scattered during the winter.

Infestations Discovered in 1926

During the summer of 1926, Federal men scouted all of the shore towns of Connecticut, and also the towns of North Stonington, Ledyard, Montville, Essex, North Branford, North Haven, Hamden, Orange, Woodbridge, and New Canaan. As a result of this scouting, one infestation was found near Woodmont in the town of Milford, and several others in the towns of East Lyme, Waterford, New London, Groton, and Stonington. A second scouting was given around all infestations, but no borers could be found in Old Saybrook or Bridgeport, which were infested in 1925, though both places were scouted twice. Certain portions of Groton and Stonington infested in 1925 were not found infested in 1926.

MILFORD

The infestation in Milford was discovered in a five-acre field of sweet corn near the house of the owner, Mr. J. R. Quirk, in the eastern or Woodmont section of the town. In all, only four borers were found. Three were found at the time of the first examination, August 27, and another was found on September 7, when the field was rescouted. Altogether 257 fields, or about 472 acres of corn were scouted in the town of Milford.

Late in November, all corn stalks, weeds and trash in the infested field, and also in a two-acre field close by, and all weeds and trash around both fields were burned by State and Federal men working together. About 1,800 gallons of furnace oil were used, and the labor amounted to 45 man days.

EAST LYME

Corn borer infestations were found in East Lyme in 1923 and 1924, but none in 1925. Those of 1923 and 1924 were perhaps two miles apart. In 1926, six separate infestations were found, having a total of 28 borers. Four of these infestations were in small adjoining gardens, one on the Morton farm only a stone's throw away, and the sixth was in a two-acre field of corn about two miles to the eastward beside the State road and with no other

corn fields or weed areas near it. All these infestations are in or near the village of Niantic.

Clean-up burning work was started at the Morton farm, December 1, by State and Federal men. The small back-yard gardens were also completed on December 3, and the sixth or last infestation in the town was burned on December 4, but on account of a snowfall followed by more snow, it was necessary to postpone all further clean-up efforts until the spring of 1927. The work already accomplished in East Lyme required 49 man days, 2,373 gallons of oil were used, and about 12 acres of corn fields and weed areas were burned over. Only a small amount of work will be necessary to finish cleaning up the infestations in this town.

WATERFORD

For the first time the town of Waterford was found infested by the European corn borer in 1926. Four separate infestations occur in the southwestern or Millstone section of the town. Three of them are on one farm, and the fourth is in a small garden about a quarter of a mile away. Altogether 37 borers were found. Clean-up operations will involve burning some fairly large fields of corn and adjacent weed areas.

NEW LONDON

In 1925, a corn field of about one-half acre on Park Street, owned by Mr. J. J. Higgins, was found infested, and all corn, weeds and trash on it were burned, and similar treatment was given six other small gardens in the neighborhood. In 1926, eleven borers were found in corn on the same field at Mr. Higgins'. A second infestation was discovered in the rear of the Pequot Colony Dairy Farm, on Montauk Avenue, where a bottling plant is maintained in a residential section. Three borers were found here, and it will be necessary to burn over a large field of weeds in the spring clean-up.

GROTON

The European corn borer has been found in Groton each year since 1923. Though burning has been the clean-up method practiced each year, 50 borers were found in 1926, one in the borough of Groton, and the others in the village of Noank, where the infestation was rather general last year. In fact, all infested yards in Noank may be considered as belonging to one rather large infestation. Considerable clean-up work will be necessary here in the spring. Last year three infestations were found in Groton in the village of Mystic, but this year no borers could be found there.

STONINGTON

In 1926, a total of 36 European corn borers was found in eight separate infestations in Stonington. With one exception, all were in small back yard gardens in the eastern portion of the village of Mystic, where infestations were found in 1925. The other infestation is situated on the farm of James E. Lord, on Lord's Hill at Quiambog, where two borers were found, and where a small infestation occurred in 1925. Control measures will begin in the spring as soon as weather conditions permit. In 1925, infestations occurred near Old Mystic and Lower Pawcatuck, but no borers could be found at these places in 1926.

It is interesting to note that in certain cases isolated infestations in several towns have apparently been completely eradicated, as no borers could be found in the vicinity the following year. In certain other cases similar infestations have not been eradicated, and this is particularly true where borers occurred in several adjoining yards in Mystic and Noank. Here the householders often clean up their back yards by dumping corn stalks, weeds and rubbish into the water. This is a poor practice, as it leaves the material on the shore or it may be washed away by the tides and other infestations started. In one case in Noank, the clean-up men had to fish the wet material out of the water and place it upon the shore above high-water mark to let it dry for a few days before it could be burned.

The following table shows the results of scouting by the Federal men, to whom we are greatly indebted for their help and co-operation:

SUMMARY OF SCOUTING FOR EUROPEAN CORN BORER, 1926

County	No. Acres Corn Scouted	No. Fields Scouted	No. Man Days	No. Borers Found
New London	1,335	1,815	287	165
Middlesex	517	1,168	62.5	0
New Haven	1,687	1,324	166.5	4
Fairfield	866	1,208	104	0
Total	4,405	5,515	620	169

Federal Corn Borer Quarantine

Since preparing this Report for publication, a Federal quarantine has been placed upon the towns of East Lyme, Waterford, New London, Groton, and Stonington, on account of the European corn borer. This quarantine became effective March 1, 1927, and the quarantined area is shown in figure 3. Evidently this area is connected through Rhode Island with the large infestation in eastern New England, but we expect that clean-up measures will

be taken wherever infestations are found, in the hope that the spread of the pest may be materially retarded by such means.

The quarantine restrictions provide that corn on the ear and broom corn (including all parts of the stalk), sorghums, sudan grass, celery, green beans in the pod, beets with tops, rhubarb, oat and rye straw as such or when used as packing, cut flowers or entire plants of chrysanthemum, aster, cosmos, zinnia, hollyhock, and cut flowers or entire plants of gladiolus and dahlia,

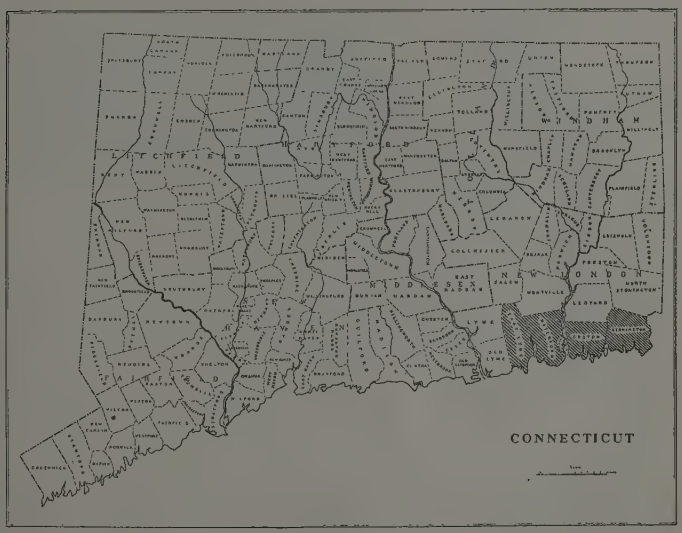

FIG. 3. Map of Connecticut; shaded area shows towns now under Federal quarantine on account of European corn borer.

except the bulbs or tubers thereof without stems, cannot be shipped interstate without inspection and certification by a Federal inspector.

Corn on the ear may be shipped within the infested area but will not be inspected and certified for shipment outside of such area. Shelled corn for seed will be examined and certified.

It is understood that a Federal inspector will soon be placed at New London or some other convenient point to take care of inspections within the quarantined area in Connecticut.

It is probable that a State quarantine will soon be placed upon this same area, to prevent the transportation of the pest in infested material to other points within the state of Connecticut.

THE JAPANESE BEETLE IN CONNECTICUT

The Japanese beetle, *Popillia japonica* Newman, was first discovered in America at Riverton, New Jersey, in 1916, and notwithstanding the enforcement of State and Federal quarantines and various other suppressive measures, it has continued to spread until it now covers a large area, including most of the states of New Jersey, northern Delaware, eastern Pennsylvania, the western end of Long Island, a portion of Westchester County, New York, and September 1, a few beetles were discovered in Stamford, Conn. The Entomologist and Assistant Entomologist Zappe visited the place on September 14, where they met Mr. Armstrong and another Federal scout, who showed them the infested yards. Four adult beetles were collected by them that day, making 18 altogether taken in Stamford. This number is too large to make it probable that the adults were brought in on shipments, trains or automobiles during the season. Had there been only two or three, such a conclusion might have been reached, but the presence of 18 seemed to indicate that the pest had been breeding there. Consequently Messrs. Zappe and Johnson visited Stamford on October 5, and made several diggings in each yard in search for grubs. None were found. The beetles discovered were in three yards on the south side of Broad Street, between Summer Street and Winthrop Street and nearly opposite the south end of Franklin Street. One beetle was found in a yard opposite on the north side of Broad Street.

Appearance of Adults

The adult beetles have a striking appearance. They vary from five-sixteenths to seven-sixteenths of an inch in length, and from three-sixteenths to nine thirty-seconds in width, or an average of three-eighths in length and one-fourth in width. The upper surfaces of head, thorax, abdomen and legs are bright and shining metallic green, with wing-covers duller and coppery-brown. The wing-covers do not project to the end of the abdomen, which shows five lateral spots on each side and two posterior spots composed of white hairs, as is shown in figure 4 and plate XIII, a. The under surface generally, including legs, is dark metallic green, and the body bears short gray hairs.

Life History

The Japanese beetle has an annual life cycle, and the adults begin to emerge about the middle of June and are usually present until the middle of October, though the period of greatest abundance extends only to about the middle of August. The females

each deposit in the soil between forty and fifty eggs, usually at the rate of four or five per day. The eggs are white, elliptical in shape, about one-sixteenth of an inch long and two-thirds as thick. They are laid separately between two and four inches beneath the surface and hatch in about two weeks. The tiny grubs are at first only one-sixteenth of an inch long, but they feed upon the

FIG. 4. The Japanese Beetle *Popillia japonica* Newman. a, adult beetle; b, grub or larva; c, egg. All enlarged about five times.

roots of grass and other vegetation and become full grown in about six weeks, when they are about an inch in length and resemble, though smaller, the common white grubs of the June beetle. They feed one or two inches beneath the surface, but on the approach of cold weather they descend to an average depth of seven inches, where they remain dormant until spring. Early in May they move upward, and just beneath the surface of the soil resume feeding and transform to pupae late in May or early in June. From two to four weeks later the adults appear.

HABITS OF THE BEETLE

About two hundred different kinds of plants, including practically all of the economic crops grown in the area, have been recorded as food plants for the Japanese beetle in New Jersey. A preference seems to be shown for apple, sweet cherry, plum, grape, blackberry, clover, soy bean, and corn. Certain shade trees are attacked, especially linden, birch, elm, horse-chestnut, sassafras, willow, and white oak. Among the ornamental shrubs, rose and althea are preferred. Many kinds of flowering plants and weeds are also attacked. Not only do the beetles feed upon the foliage, but they eat the petals of flowers, and cluster and feed upon the fruit of apple and peach trees, as shown on plate XIII, b. As many as 278 have been recorded as clustering upon a single apple.

Shallow cavities are eaten on the surface of fruits, as shown on plate XIII, c. Foliage is not wholly eaten but is skeletonized in much the same manner as by the rose chafer (see plate XIV, a).

The grubs are a serious pest in lawns, golf courses, and pastures, if they are sufficiently abundant. Wherever the infestation does not exceed one hundred larvae per square yard, as a rule no great injury follows. The injury is much more apparent in seasons of drought, because in seasons of normal or excessive rainfall the grass will make new roots before it becomes dry and brown.

Parasites

For the past seven years the Federal Bureau of Entomology has had entomologists in Asiatic countries searching for parasites that attack *Popillia japonica,* or its close allies. Though several two-winged flies and some four-winged flies have been found which attack the Japanese beetle, only one of the former, *Centeter cinerea* Ald., has become established, has extended its range, and has been recovered in the United States. This parasite lays its eggs upon the adult beetle, and the maggots kill their host in about five days.

Control Measures

The grubs in the soil may be killed by flowing upon the surface a specially prepared emulsion of carbon disulphide as is used against the grubs of the Asiatic beetle, and described on page 260.

The adult beetles may be attracted by certain chemical odors and collected in large numbers. They can then be killed by a spray formed of oleoresin or pyrethrum and a sodium oleate soap which has recently been developed in New Jersey.

Foliage and fruit may be protected by heavy applications of specially prepared arsenical mixtures, one of the most promising of which is a coated lead arsenate.

Quarantines

A Federal quarantine was placed upon the towns of Stamford and Greenwich, effective October 11, 1926. Though no beetles were found in Greenwich, an infestation was discovered in the adjacent town of Port Chester, N. Y., and in order to quarantine Stamford it was almost necessary to include Greenwich. Based on a public hearing at the Station, October 19, a State quarantine was also placed upon these two towns, becoming effective November 10. The quarantined area is shown in figure 5, and the quarantine order follows:

STATE OF CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

QUARANTINE ORDER No. 11*

JAPANESE BEETLE QUARANTINE

The fact has been established by the Agricultural Experiment Station that an injurious insect known as the Japanese beetle (*Popillia japonica*) exists in the town of Stamford, Conn., and in Port Chester, N. Y.

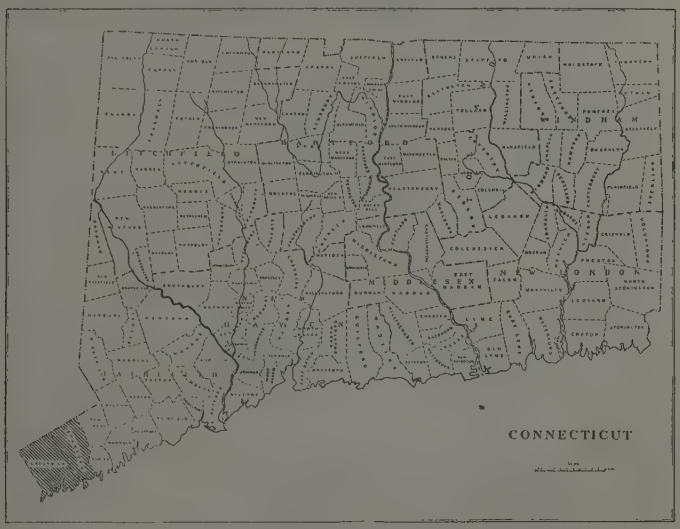

FIG. 5. Map of Connecticut; shaded area shows towns now under State and Federal quarantines on account of the Japanese beetle.

Now, therefore, I, Director of the Connecticut Agricultural Experiment Station, pursuant to the provisions of Chapter 107, Public Acts of 1925, do hereby proclaim the towns of Stamford and Greenwich to be under State quarantine, and that it shall be unlawful to move from these towns to other points within the State (1) farm, garden, and orchard products of all kinds; (2) grain and forage crops of all kinds; (3) nursery, ornamental, and greenhouse stock, and all other plants; and (4) sand, soil, earth, peat, compost, and manure, except under the conditions prescribed in the following rules and regulations supplemental to this quarantine.

* Published in Bulletin of Immediate Information, No. 56, November 10, 1926.

RULES AND REGULATIONS

Regulation 1.—Definitions.

For the purpose of these regulations, the following words, names and terms shall be construed, respectively, to mean:

1. JAPANESE BEETLE: The insect known as the Japanese beetle (*Popillia japonica* Newman) in any stage of its life cycle.
2. REGULATED AREA: Those portions of the State quarantined on account of the Japanese beetle and designated as being infested or immediately threatened with such infestation.
3. FARM PRODUCTS: Farm, garden and orchard products of all kinds, and grain and forage crops of all kinds.
4. NURSERY AND ORNAMENTAL STOCK: Nursery, ornamental and greenhouse stock and all other plants, plant roots, or portions of plants for ornamental use.
5. SAND, SOIL, EARTH, PEAT, COMPOST AND MANURE: Sand, soil, earth, peat, compost and manure of any kind, and as to either bulk movement or in connection with farm products or nursery and ornamental stock.
6. INSPECTOR: An inspector of the Connecticut Agricultural Experiment Station or the United States Department of Agriculture.

Regulation 2.—Regulated Area.

The towns of Stamford and Greenwich, in Fairfield County, and including any cities or borough within their limits.

Regulation 3.—Extension or Reduction of Regulated Area.

The area designated in Regulation 2 may be extended or reduced, as found necessary by the Connecticut Agricultural Experiment Station. Due notice of any extension or reduction of the areas affected thereby will be given in writing to the transportation companies doing business in the areas, and by publication in newspapers selected by the Connecticut Agricultural Experiment Station.

Regulation 4.—Regulation of Movement of Farm Products.

Regulation 5.—Regulation of Movement of Nursery and Ornamental Stock.

All movement of nursery and ornamental stock from the regulated area to other points outside such area, but within the State, shall be subject to the details of regulation and control indicated in the Appendix of Federal Quarantine No. 48 (Fifth Revision), and shall be permitted only upon full compliance with Regulations 6, 7 and 8 of this order: Provided, that such movement of nursery stock originating within or being transported through the regulated area during the period June 15 to October 15, inclusive, is prohibited to points outside such area within the State, unless protected from possible infestation in a manner or by a method approved by the inspector. All movement of nursery stock within the regulated area shall be subject to the details of regulation and control indicated in the Appendix of Federal Quarantine No. 48 (Fifth Revision).

Regulation 6.—Regulation of Movement of Sand, Soil, Earth, Peat, Compost and Manure.

(1) As a condition of certification of sand, soil, earth, peat, compost or manure for shipment both within the regulated area and from the regulated

area to other points within the State, all such movements of such articles shall be subject to the details of regulation and control indicated in the Appendix of Federal Quarantine No. 48 (Fifth Revision).

(2) The movement of any sand, soil, earth, peat, compost and manure originating within, or being transported through the regulated area to other points outside such area within the State, during the period June 15 to October 15, inclusive, is prohibited unless protected from possible infestation in a manner or by a method approved by the inspector.

Regulation 7.—Inspection, Certification and Marking a Condition of Transportation.

Each car, vehicle, box, basket, or other container of any of the articles, in process of any movement which is restricted by Regulations 4, 5 and 6, shall be plainly marked with the name and address of both consignor and consignee, and shall bear a certificate stating that the contents have been certified by the inspector, as free from the Japanese beetle: Provided, that in case of such article moved in carload or other bulk shipments the certificate shall accompany the way-bills, conductors' manifests, memoranda, or bills of lading, or in case of truck or other road vehicles, the certificate shall accompany the vehicle. Any certificate, provided for in this act, which is forged, counterfeited, altered or defaced shall be considered as invalid and any person who shall forge, counterfeit, alter or deface such certificate shall be deemed guilty of violating the requirements of the order of the Connecticut Agricultural Experiment Station applying to the Japanese beetle and shall be liable to the penalty as outlined in Chapter 107, Public Acts of 1925.

Regulation 8.—Conditions Governing Inspection and Issuance of Certificate.

Whenever it is intended to move any of the articles or materials restricted by this quarantine order from the regulated area to points outside such area within the State, application for inspection and certification shall be made as far as possible in advance of the probable date of shipment, specifying the article and quantity to be shipped, method of shipment, and the names and addresses of both consignor and consignee.

Applicants will be required to assemble the articles and materials at such points as the inspector shall designate and to place them so that they may be readily inspected. All charges for storage, cartage, and labor incident to inspection other than the services of the inspector shall be paid by the shipper.

In case of any of the articles enumerated, where absolute freedom from infestation cannot be determined by the inspector, certification will be refused.

Regulation 9.—Cleaning of Cars, Trucks, Boats, Wagons and Other Vehicles.

Railway cars, trucks, boats, wagons, and other vehicles which have been used in transporting any article covered by this quarantine within the regulated area, must be thoroughly swept and cleaned before they will be allowed to move in transportation to other points outside the regulated area within the State.

Regulation 10.—Moving or Receiving Articles in Violation of Regulations.

No person shall move or direct any other person to move any article in violation of these regulations. No person shall receive or direct any other person to receive any article moved in violation of these regulations.

Regulation 11.—Carrying or Transporting Living Japanese Beetles outside the Regulated Area.

No person shall move or carry, or direct any other person to move or carry, a living Japanese beetle to any point outside the regulated area.

This order shall take effect November 10, 1926.

W. L. SLATE, JR.,
Director, Connecticut Agricultural Experiment Station

Approved:

JOHN H. TRUMBULL,
Governor

PENALTY

Chapter 107, Public Acts of 1925, provides that "Any person interfering with the performance of such duty or violating the quarantine regulations established under this act shall be fined not less than ten nor more than fifty dollars."

APPENDIX

Copies of the Appendix to Federal Quarantine No. 48 (Fifth Revision), which relates specifically to shipments of nursery or ornamental stock, and sand, soil, manure, etc., may be obtained by applying to any of the following:

Japanese Beetle Office, 42 West First Street, Mount Vernon, N. Y.
Japanese Beetle Laboratory, Riverton, N. J.
Federal Horticultural Board, Washington, D. C.

APPLICATIONS FOR INSPECTIONS

Applications for inspections and certificates or permits to move nursery or ornamental stock, sand, soil, manure, etc., should be made to the Japanese Beetle Office, 42 West First Street, Mount Vernon, N. Y.

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A CO-OPERATIVE PROJECT IN CONTROLLING THE ASIATIC BEETLE, *Anomala orientalis* Waterh.

Late in the summer of 1925, the grubs of the Asiatic beetle had injured so many lawns that numerous complaints were made to the Station. At our request, some specialists from the Federal Bureau of Entomology visited New Haven and examined the conditions. Later they submitted a report recommending that life history studies and suppressive measures be inaugurated, and that the work be done co-operatively by the State and the Bureau of Entomology. Congress was asked to appropriate funds for the purpose and finally made $5,000 available July 1, 1926. No special appropriation had been made by the State for this work but the general appropriation for the State Entomologist can be used for the study or control of any insect. Though most of this had been allotted to various projects, it was thought best, if needed, to use some of it on the Asiatic beetle. Some of the property owners expressed a willingness to contribute toward a fund to help defray the costs of the treatment, and the matter was therefore brought before the executive committee of the Edgewood Civic Association. The writer was invited to address the Association at its annual meeting November 10. Lantern slides were shown of the different stages of the insect and its injury to lawns, and a description given of its discovery in this country at New Haven, together with all available information regarding its life history, habits, injury, probable spread and means of control. The Association passed a resolution authorizing the president to appoint a committee to raise funds for control work, to be disbursed by the treasurer on vouchers approved by the Entomologist.

Bulletin of Immediate Information No. 52 was distributed to every house in the infested area. The names of residents and owners were checked carefully by the committee and a certain number assigned to each of some fifty workers who were asked to solicit and collect funds from that region. On March 25, a public meeting in the Sheridan Junior High School was addressed by Messrs. Loren B. Smith and W. E. Britton. About $4,500 was collected from owners and residents. The Association also

asked the Board of Aldermen for an appropriation of $2,500, which was granted. Thus funds were obtained from four different sources.

The advisory committee, consisting of Messrs. A. L. Quaintance and L. B. Smith of the Bureau of Entomology, and W. L. Slate, Jr., and W. E. Britton of this Station, conferred on the matter and

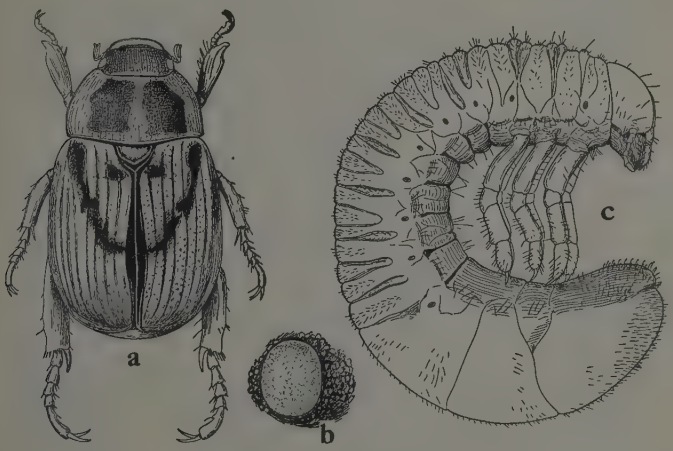

FIG. 6. The Asiatic beetle, *Anomala orientalis*. a, adult beetle. b, egg. c, grub or larva. All enlarged about five times.

decided that some very careful and thorough studies should be made on the life history and habits of the insect; that a State quarantine should be established; and that an attempt should be made to eradicate the pest.

After due notice, a public hearing was held at the Station on April 5, and a quarantine established, effective April 15, including the area between Yale Avenue, Willard Street, Forest Road, Cleveland Road, Central Avenue, and Chapel Street.

Mr. J. Peter Johnson, who had been for four years connected with the Japanese beetle work in New Jersey, was engaged to take charge of the soil treatment and to enforce the quarantine. The research work was placed in charge of Mr. R. B. Friend, assistant entomologist of this Station, and Mr. Paul A. Davis was employed to assist him.

The premises at 132 West Elm Street were leased for the season and used as headquarters. A small barn on the premises was readily adapted to serve as an office and for storage purposes. In

the rear a small insectary was built for life history investigations. This is about 10′ x 22′ and constructed in two sections, one about 10′ x 10′ and the other about 10′ x 12′, the former having a boarded roof covered with roofing felt, and the latter having a roof of hot-bed sash, which is easily removed. These two sections

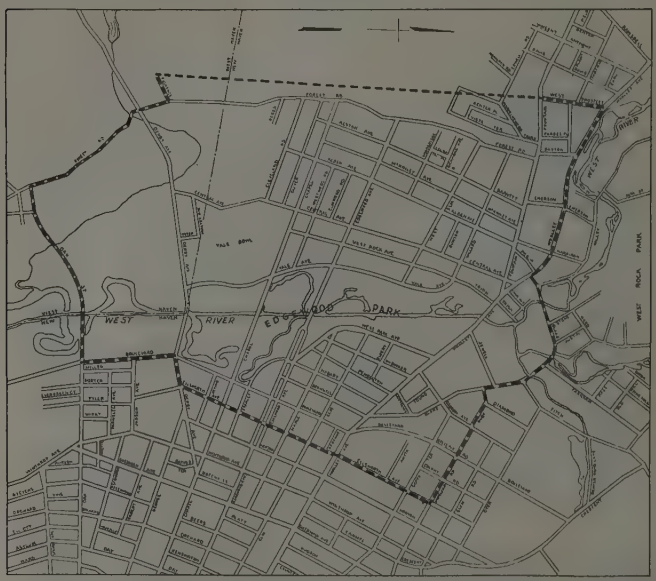

FIG. 7. Map of the Westville section of the City of New Haven. The area enclosed by the heavy dotted line is now quarantined on account of the Asiatic beetle.

are fastened together but can be readily separated for moving elsewhere at the expiration of the lease. The lower portion of the entire frame is sheathed with an artificial sheathing material and painted. The upper portion of the frame is covered with wire netting. There is a screen door in each end and another in the partition separating the two sections. The smaller section is insect tight, being covered with copper wire with a fine mesh. The larger section is covered with chicken wire with an inch mesh. A view of this insectary and a front view of the premises are shown on plate VII. This property has served very well as a place for headquarters and for insectary work. The lease has been

extended for the coming season. Good progress has been made in the investigations, but another season is necessary to complete them.

The money expended in 1926 on the Asiatic beetle project is shown, with the amount from each source, in the following table:

Source of Funds	Amount Expended
Edgewood Civic Association	$4,086.71
City of New Haven	2,471.83
Federal Bureau of Entomology	5,000.00
State of Connecticut	5,530.58
Total	$17,089.12

Of the $17,089.12, $7,884.59 was expended for labor, and $4,244.21 for emulsion. An additional charge of $1,500 for emulsion used, and not included in the figures given above, had to be paid later, chiefly from State funds.

A more detailed report on the soil treatment work has been prepared by Mr. Johnson and will be found on page 262.

The quarantine was revised in November to include additional territory, some of which was found infested by adult beetles during the summer. This present quarantined area is shown in figure 7.

Quarantine Order No. 10 became effective November 10, 1926, and is as follows:

STATE OF CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

QUARANTINE ORDER No. 10
Concerning Asiatic Beetle

The fact has been determined that the Asiatic Beetle, *Anomala orientalis* Waterhouse, now occurs outside the area regulated under Quarantine Order No. 8, and it seems advisable to revise and extend the regulations to include the additional area.

Now therefore, I, Director of the Connecticut Agricultural Experiment Station, pursuant to the provisions of Chapter 107, Public Acts of 1925, do hereby declare and order that the area bounded by Whalley Avenue from West Prospect Street eastward to Blake Street, to Ruby Street, to Moreland Road, to Ellsworth Avenue, southward to Derby Avenue, to Boulevard, to Oak Street, westward to Forest Road, northward to Florence Avenue, westward to the end of Florence Avenue (a point about 400 feet west of Forest Road), thence on a straight line northward to West Prospect Street, to Whalley Avenue, and all territory within these boundaries being partly in New Haven and partly in West Haven, shall be a regulated area out from which, until further notice, the movement of certain articles and materials will not be permitted except where inspection or treatment is prac-

ticable and permits are issued by some person or persons authorized by me to issue such permits. The restricted articles and materials are as follows:

1. Soil of any kind, including sand and loam.
2. All out-door plants with or without soil; potted plants which have been set on or in the ground out of doors between June 1 and September 30.
3. Turf or sod trimmings.
4. Lawn clippings during the period between June 15 and September 15.
5. Ground litter, weeds, manure, and compost which has lain upon the ground.
6. All cut flowers during the period between June 15 and September 15.

This order does not affect such materials originating outside of and passing through the regulated area.

This order shall take effect November 10, 1926.

W. L. Slate, Jr.,
Director, Connecticut Agricultural Experiment Station.

Approved:
John H. Trumbull,
Governor.

Penalty

Chapter 107, Public Acts of 1925, contains the following provision: "Any person interfering with the performance of such duty or violating the quarantine regulations established under this act shall be fined not less than ten nor more than fifty dollars."

The foregoing regulations do not constitute an embargo, and the movement of these materials will be prohibited *only* where there is great danger of carrying the pest into uninfested territory and where inspection or treatment is considered impracticable. Permits may be issued for the movement of such materials which are not in danger of carrying the insects or which may be rendered safe by inspection or treatment.

Where to Obtain Information

Mr. J. P. Johnson has been placed in charge of enforcing this quarantine, and any one desiring to move plants and soil should make application to him. Headquarters have been established at 132 West Elm Street, telephone Colony 7215, where he may be reached during the summer months. From December 1 to April 1, the headquarters office will be closed and Mr. Johnson may be reached at the Agricultural Experiment Station, 153 Huntington Street, or by telephone, Pioneer 6450, or Liberty 1253.

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REPORT OF QUARANTINE AND CONTROL WORK FOR THE ASIATIC BEETLE DURING 1926

J. PETER JOHNSON

Organization:

The organization was employed mainly for the control work, as very little assistance was needed in enforcing the quarantine. In addition to the man in charge, one assistant, Mr. Charles E. Brown, supervised the treatment, diggings, and scouting in the field. A crew of eight men was employed to make the spring diggings, and this number was increased to 25 for the treatment work. On June 30 the force was reduced to 15 men to carry on the summer scouting. In September the force was increased, numbering 25 at the peak of the fall treatment and digging work.

Quarantine:

On April 15, 1926, a quarantine was established on account of the Asiatic beetle and the quarantined area included approximately 400 acres of land in the Westville section of New Haven. Shortly afterward copies of the Bulletins of Immediate Information No. 52 and No. 53 were left at each home within the infested area. This was done to inform the inhabitants of the quarantine and to make it immediately effective.

From time to time requests were made for the inspection of plants, soil, etc., to be shipped out from the area. In all, 28 cer-

tificates were issued certifying 2 shipments of cut flowers, 12 shrubs and evergreens, 229 plants, 963 bulbs and roots, and three excavations. The form of certificate used is as follows:

STATE OF CONNECTICUT

AGRICULTURAL EXPERIMENT STATION

New Haven, Conn.

CERTIFICATE OF INSPECTION FOR THE ASIATIC BEETLE

(Plants, Soil, Garden Litter, etc.)

This is to certify that I have examined or caused to be examined under Quarantine Order No. 8, as authorized by Chapter 107, Public Acts of 1925, the contents of this shipment and found it to be free from the Asiatic Beetle. It is hereby permitted to be moved, in accordance with the provisions of Quarantine Order No. 8.

Issued to .....

Address .....

Consignee ..... Via.....

Street and Number .....

City ..... State.....

Date .....

Shipment consists of .....

.....

.....

AGRICULTURAL EXPERIMENT STATION
Wm. L. Slate, Jr., *Director*
W. E. Britton, *State Entomologist*
New Haven, Conn.

J. P. JOHNSON,
In Charge of Quarantine.

Per.....

Void after.....No. .....

The soil about the roots of twelve trees was treated with carbon disulphide emulsion for possible grub infestation, allowing their certification.

The quarantine was revised in the fall and included about 1,000 acres of new territory. In this area there is located a large sand bank from which shipments are made daily and this necessitated a new certificate for bulk shipments. A total of 28 of these certificates was issued, certifying 632 cubic yards of sand.

During the year 12 excavations were under observation as to the disposal of the soil, and three refuse collectors were approached and their co-operation secured in enforcing the quarantine.

STATE OF CONNECTICUT

AGRICULTURAL EXPERIMENT STATION

New Haven, Conn.

No. .....

CERTIFICATE OF INSPECTION ON ACCOUNT OF THE ASIATIC BEETLE

Date .....192..

This is to certify that I have examined or caused to be examined, according to Quarantine Order No. 11, as authorized by Chapter 107, Public Acts of 1925, and found to be free from the Asiatic beetle, the following products:

Shipped by .....
(Name and address)

Consigned to .....
(Name and address)

Shipment consists of .....

.....

via .....Car Number.....

This certificate is void after .....

J. P. JOHNSON,
In Charge of Quarantine.

Per .....

AGRICULTURAL EXPERIMENT STATION
Wm. L. Slate, Jr., *Director*
W. E. Britton, *State Entomologist*
New Haven, Conn.

Diggings:

In the spring it was thought necessary to make diggings throughout the quarantined area to determine the nature and extent of the infestation, and 1,800 diggings were made, approximately 50 feet apart. The infestation was found to be spotted, and in places there were as many as 1,000 grubs in a square yard.

Diggings were resumed in the fall, as the summer scouting work did not give all the information needed for intensive control work. The spring work was duplicated in addition to all areas in which adult beetles were found, and altogether 2,776 diggings were made.

During the season 50 or more complaints of possible grub infestations were received from outside of the area. All such complaints were investigated, and on May 17, 1926, an infestation was found at 437 Savin Avenue, West Haven, and on October 4, 1926, another infestation, one city block in extent, was found on Washington Manor Avenue, West Haven.

Because of the nature of the territory infested by the beetle, and also because of its habits, it was necessary to make nearly all the diggings in lawns. In the spring the people as a whole co-operated exceedingly well, and in the majority of cases where objections were made, the work was explained and co-operation secured. The work in the fall was to a great extent a repetition of the spring work, and very little opposition was encountered.

Emulsion:

The insecticide used in the control work was emulsified carbon disulphide. This emulsion is identical with that used to control the Japanese beetle, *Popillia japonica* Newman, and was recommended by the Japanese Beetle Laboratory. The formula is as follows:

Soap:

50 grams of lump rosin (grind), dissolve in sodium hydroxide (heat)
50 cc. of oleic acid.
135 cc. of a 7% sodium hydroxide solution.
450 cc. of water.

The soap is used at the rate of 3 parts to 7 parts of commercial carbon disulphide and this mixture is agitated until it emulsifies.

All of the emulsion was purchased from the I. P. Thomas & Son Company, Philadelphia, Pa., at a cost of $300 per ton. The majority of it was sent by freight, and the average delivery was made in eight or nine days. However, there were a few deliveries made by express, arriving in three days from Philadelphia. The emulsion arrived in perfect condition and was used immediately excepting one ton which was stored in the headquarters during the summer months. This emulsion stood up very well and was used for fall treatment.

Hose:

The standard hose used in applying the liquid was one inch in diameter. As it was known that the carbon disulphide emulsion had a deteriorating effect upon rubber hose, three grades of rubber hose were purchased in the spring in order to test their value. These were nine-ply and six-ply high-pressure hose and three-ply water hose. The nine-ply hose proved to be the poorest hose, while the three-ply water hose was the best. However, not one of the three grades was very satisfactory, as the inner lining either crumbled or separated from the hose proper, causing it to bulge and preventing the free passage of the liquid through it.

The Japanese Beetle Laboratory lent some equipment to carry on the control work, and a cheap grade of hose was included. This hose was used with great success and lasted throughout the season without any ill effects. As a result, this type of hose was purchased for the fall work and served satisfactorily.

In the spring of the year the house sill-cocks were considered as the logical source of water supply as determined by past experience with the machines. This source, however, proved to be inefficient because of the low pressure encountered, causing very much trouble in diluting the insecticide properly and permitting but a small amount of area to be treated in a day. Whenever possible, fire hydrants were used, and this enabled the machines to work at a maximum until a one-inch hose line 200 feet or more in length was needed. The friction of the water passing through the small-caliber hose would then increase to a point causing trouble identical with that encountered in the use of the sill-cocks.

During the summer, standard single-jacket, canvas-covered, rubber-lined, 2½-inch, 2-inch, and 1½-inch hose were purchased and tested. The 2½-inch hose gave the greatest flow of water and the desired results. This hose was adopted for hydrant use in the fall and enabled double the area to be treated, as compared with the spring work, in less time.

It was necessary to secure a written permit from the New Haven Water Company and the fire chiefs of New Haven and West Haven to use the fire-hydrants.

Machines:

In the latter part of April four proportioning machines were ordered from the I. P. Thomas & Son Company, Philadelphia, Pa. These machines are sold for about $70 each, with the understanding that they can be used only in applying I. P. Thomas carbon disulphide emulsion. Three machines, with the necessary equipment, were borrowed from the Japanese Beetle Laboratory for the spring work, and one for the fall work. Each machine has a capacity of 600 gallons an hour. However, because of the large area to be treated, it was thought that these machines were not

large enough to treat the area efficiently. Therefore, during the summer a larger machine was ordered and one with a capacity of 1,200 gallons an hour was made by the I. P. Thomas & Son Company and sent to us for testing. It proved to be a decided improvement and was in use during the fall.

The machines can be used in treating lawns, terraces, gardens, and ornamental plantings when proper precautions are observed. One-inch hose is used on all the machines, and a six- and a nine-inch special nozzle is used on the 600-gallon and 1,200-gallon machines respectively.

Treatment:

The insecticide used in the soil treatment for the Asiatic beetle grub is carbon disulphide emulsion, as recommended by the Japanese Beetle Laboratory. This was diluted at the rate of one quart of the emulsion in 50 gallons of water and three pints of this liquid applied to one surface square foot by the proportioning machine. This dose is effective to a depth of nearly three inches, obtaining a grub kill as high as 98% when applied properly.

During the spring season as much of the infested territory was treated as the time permitted. Every square foot in this area, including lawns, gardens, and ornamental plantings, received the treatment. Because of the nature of the surface to be treated, three men were needed to operate a machine and handle the hose, in order to minimize the possibility of damage to plants and shrubbery. In the fall, however, only lawns were treated, and two men were sufficient to operate a machine.

Seven machines, each with a capacity of 600 gallons an hour, were used during the spring treatment, and four similar ones and one of 1,200 gallons' capacity for the fall work.

Some promising results were obtained with a dose of one quart of emulsion diluted in 100 gallons of water and applied at the rate of one gallon to a square foot. Grubs were killed to a depth of eight inches, and in some instances 100% control was obtained. However, more work is necessary before any recommendation can be made.

Westville is primarily a residential section having progressive citizens who take pride in their homes, lawns and ornamental plantings. The plant world is well represented with annuals, perennials, shrubs, evergreens and deciduous stock. In the course of treatment everything received the required amount of insecticide, and very little injury resulted. Very few complaints were made concerning annuals and perennials and the injury to them was negligible. Japanese barberry proved to be somewhat susceptible to the treatment, and extreme care was exercised to prevent possible injury.

However, in considering the great number of shrubs and ever-

greens treated, the injury was practically negligible and largely due to flooding or weakening by insect attack.

Lawn injury was noted in low areas where flooding took place and in new or poor turf. As the treatment was continued into early July, it was evident that the turf became more susceptible at the approach of hot weather. The total lawn injury did not exceed 1½%, while the actual surface treated was 43.5 acres.*

Gardens were treated after the seeds had been planted and the crops were noted to grow normally. Annual plants received the treatment just after transplanting into the garden with excellent results. The perennials withstood the treatment very well and not one case of injury was reported.

The policy for controlling the Asiatic beetle during the past year was to treat every square foot possible in the infested area. Surprising co-operation was given by the residents, and only three people objected to the treatment being made during the year. However, when the object of the work was recognized by these people, they also gave their co-operation.

The infestation at 437 Savin Avenue and the area surrounding it were treated in the spring and again in the fall. A much heavier dose was applied to the area actually known to be infested. This was possible due to permission from the property owner, who was willing to sacrifice his lawn in securing a complete control. Only one beetle was found during the summer, and not one grub was discovered during the fall diggings. It is evident that very good results were obtained and the insect may have been exterminated at this place.

Treatment was made late in the fall at the Washington Manor Avenue infestation, and it is certain that favorable results were obtained considering the lateness of the season. This infestation will be treated again in the spring with extermination in view.

Scouting:

The adult beetle is more readily seen when resting than when flying. It is a rapid flyer and may skim along a few feet above the ground or high in the air. Beetles were found at night, resting on telegraph poles, on the ground, and as many as 18 were caught in a half hour flying against the glass and on the sill of a brightly illuminated store window. The territory surrounding the known infested area was thoroughly scouted, and beetles were found north, south, and east of the quarantined area. The last beetle in the field was found on August 28. There was an average of twelve men scouting daily during the entire season. The Elm City Nursery in Woodmont was scouted repeatedly during the summer and no infestations found.

* The total area including houses, garages and sidewalks would be approximately 100 acres.

Results:

In the spring there was much evidence of grub injury to lawns on Alden Avenue, Edgewood Avenue, Marvel Road, McKinley Avenue, Central Avenue, West Rock Avenue, Yale Avenue, Woodbridge Avenue, Chapel Street, Westwood Road, Elmwood Road, and West Elm Street. After the spring and fall treatments were completed, the only evidence of grub injury was on land in McKinley Avenue, which was injured prior to treatment, on Marvel Road, and on one lawn on Woodbridge Avenue. These were not treated in the fall. Thousands of grubs were killed by the treatment throughout the area, and from a control standpoint the evidence is that the work was being carried on successfully.

On August 31, 1926, an experiment was begun on Elmwood Road to control grubs by the use of acid lead arsenate ($PbHAsO_4$) in the soil. This was possible through the co-operation of Professor Schrieber in letting us have the use of a plot of turf which was infested with grubs. The arsenate of lead was applied at the rate of 1,500 pounds to the acre, and grass seed was sown in the treated soil. The seed germinated well and was growing excellently as winter set in, giving promise of a good lawn in the spring. However, some time must elapse before the results can be determined. This method is being applied successfully in the control of the Japanese beetle and is duplicated here to verify its ability to control the Asiatic beetle grub.

THE SATIN MOTH IN CONNECTICUT

Another new tree pest has appeared in Connecticut, in the satin moth, *Stilpnotia salicis* Linn., a species from Europe which was first discovered in America at Medford, Massachusetts, just north of Boston, in July, 1920. During the same month a smaller colony of this pest was found near Vancouver, B. C. The Massachusetts colony has now spread westward as far as Brookfield, Massachusetts, through Rhode Island, into eastern New Hampshire as far north as Conway, in southwestern Maine as far as Bangor, and during the early fall Federal inspectors discovered an egg-cluster in Thompson, and another in Stonington, Connecticut. The infestation in British Columbia has evidently spread, because seven towns in the State of Washington are now infested. All territory within the United States mentioned above was placed under the revised Federal quarantine No. 53, effective November 15, 1926, which prohibits the movement of all poplars and willows from the infested territory to points outside the area. The Connecticut towns quarantined on account of the satin moth are shown in figure 8.

Characteristics of the Insect

Both sexes of the moths have the appearance of being entirely white, and the peculiar satin luster gives them the name of satin moth. As a matter of fact, the eyes, head, thorax, abdomen, and a portion of the legs are black, but are so completely covered by the long white hairs that the black does not show. However, the hairs soon get rubbed off so that the abdomen and some other parts show blackish, and the antennae also appear dark. Females

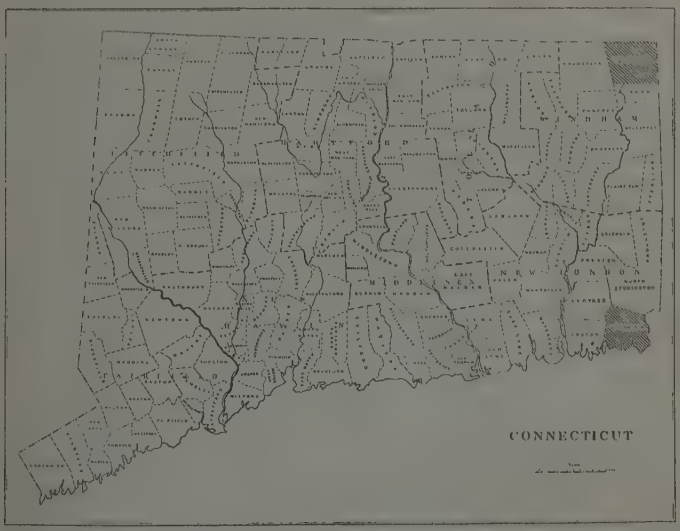

Fig. 8. Map of Connecticut; shaded areas show towns now under Federal quarantine on account of the satin moth.

have a wing-expanse of about two inches, and the males about one and three-fourths inches.

The egg-clusters are from half to three-fourths of an inch in length, usually somewhat elongated, and perhaps two-thirds as wide as long. They are very conspicuous and are covered with a glistening white substance which holds the eggs together firmly. They are usually laid on the under side of a leaf, but may be deposited on the trunk or branches of trees, or upon stones, grass, weeds, or even upon the ground, if no other convenient place is at hand.

The caterpillars vary from one and one-half to two inches in length when full grown. The head is black and the body blackish,

with finely reticulated white markings, and two narrow broken subdorsal lines between which is a row of large spots or blotches which range from square to dumb-bell-like in shape. The tubercles are reddish-brown and bear yellowish-brown hairs.

The pupa is nearly black, covered with long white or yellowish hairs, and is from three-fourths to an inch in length.

Male and female moths, caterpillars and hibernating cases are shown on plate XII, a and b.

Habits and Life History

The moths appear in July, and each female usually lays about 550 eggs, though these may not all be laid in one place; particularly if disturbed, the female moth will continue egg-laying elsewhere and frequently lays more than one egg-cluster. The eggs hatch in about fifteen days.

When the larvae have reached the third stage and are about one-fourth of an inch long, they make pockets or hibernating shelters in crevices in the bark or other favorable situations. Occasionally two or three larvae are found in one shelter, but usually each has its own individual pocket. A silk case is then made, in which the larva spends the winter. Externally this case resembles the bark of the tree so closely that it is very inconspicuous and so difficult of detection that the ordinary methods of inspection fail to reveal it. Hence inspection is not attempted in the enforcement of the quarantine; all shipments out of the area are prohibited.

In spring the larvae emerge from their winter cases and feed upon the newly expanding foliage. They reach larval maturity about July 1, and spin loose cocoons, sometimes by drawing together the edges of the leaves, sometimes in crevices of the rough bark, and again in rubbish or on the sides of buildings. In about nine days the moths emerge. There is one annual generation.

Control Measures

The egg-clusters may be saturated with creosote to kill the eggs, as is done with the gipsy moth, but only a portion of them can be so treated because they are not all accessible. Some of them are laid on the small twigs, out of reach, and climbing for them is particularly hazardous on poplars and willows on account of the weak and brittle nature of the wood.

Spraying heavily with lead arsenate as soon as the trees are in full leaf seems to be the best remedy. Burgess recommends as high as ten pounds of the poison to one hundred gallons of water, with some kind of "sticker" added. In severe infestations it may be necessary to spray again about the middle of June.

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ABUNDANCE OF *ORMENIS PRUINOSA* SAY ON IBOTA PRIVET

B. H. WALDEN

On August 5 the writer visited Bridgeport to examine the Ibota privet hedges around the houses owned by the Bridgeport Hous-

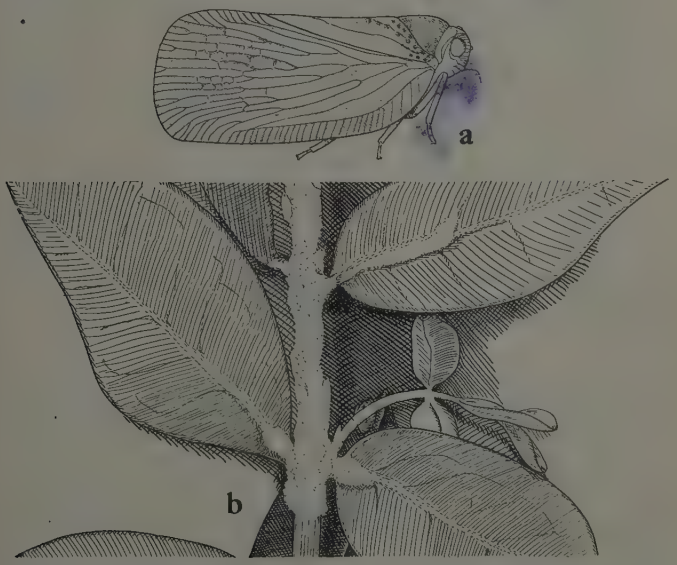

FIG. 9. The mealy flata, *Ormenis pruinosa* Say. a, adult, enlarged about seven times. b, privet twig showing wax secretion, twice natural size.

ing Company which were reported to be infested with insects. This Company owns over 700 houses, the grounds of which have

been planted with shrubbery and cared for by the Company at considerable expense. The hedges were about ten miles in extent and were found to be badly infested with the mealy flata, *Ormenis pruinosa* Say. Many of the inside branches were white with the wax-covered, last-stage nymphs, and adults were emerging on the hedges situated in sunny exposures. While the insects were very abundant there was no indication of injury to the privet, but the owners, expecting serious injury, had tried a number of contact insecticides with very little success.

The insects were so well protected by the dense foliage that it was very difficult to reach them with a spray of sufficient force to penetrate the waxy secretion with which they were covered.

In front of one of the houses a man was driving the insects out of the hedge onto the concrete walk with a strong stream of water from a garden hose. This did not drown the insects, and after the water had drained away many of them returned to the plants. It was suggested that a large number of the insects could be killed by having a second man with a stiff broom crush them on the walk before they could return to the privet.

The mealy flata was present in much smaller numbers on several other kinds of shrubs, but no injury was observed. A few plants of dahlia and salvia in one yard were badly infested and had been noticeably injured. This insect and its wax secretions are shown in figure 9.

MOSQUITO CONTROL WORK IN CONNECTICUT

Season of 1926

R. C. Botsford

Since 1915 the Director of the Connecticut Agricultural Experiment Station has had authority by act of the legislature to order mosquito breeding places eliminated when funds are provided for that purpose. Under the present law the Director shall keep in repair and maintain in non-breeding condition areas which have been ditched or treated to merit his approval and formally accepted by him for state maintenance.

Funds for maintenance and for making surveys and investigations are appropriated by the State as a special budget item of the Experiment Station. Formerly the law required that each town where work was done should be assessed for three-quarters the cost of both maintenance and new work. The Legislature of 1923 changed the law so that towns are no longer assessed, but the expense of maintenance is borne by the State. As the increased

appropriations to cover this work, as requested by the Station, have not in all cases been granted, it will be impossible for the State to assume the maintenance on any more ditched areas unless increased appropriations are granted by the General Assembly. Funds may be contributed for this work by towns, associations or individuals, and this has been done in many instances when state funds have been insufficient to produce satisfactory results in a particular locality.

In 1917 the State appropriated $5,000 to pay for one-fourth the cost of extending the work, but so little money was contributed to make up the remaining three-fourths that most of the $5,000 was unexpended. Since then the State has made no appropriation for new work.

About one-third of the total salt marsh area of Connecticut is patrolled by this Station and kept free from mosquito breeding as far as possible. The remaining two-thirds are probably breeding mosquitoes which tend to migrate to treated areas and seem to nullify the work. The maintenance of the treated areas should be continued, however, so that when the work is extended the older treated areas will be non-breeding. The cost of this work has increased, and increased appropriations are required from time to time.

Three towns have recently invested a total of about $20,000 to ditch their salt marshes in anticipation of the work being maintained permanently by this Station under the Statute.

Methods of treating breeding places of mosquitoes are described in detail in previous bulletins of this Station. The control of mosquitoes which breed in fresh water swamps, receptacles that contain rain water, and in polluted bodies of water is purely a local problem and can best be effected by a local organization headed by the health officer. These mosquitoes, which include the malaria-carrying species, are seldom found more than one-quarter of a mile from their breeding places. Mosquitoes which breed in the brackish water of the salt marshes fly long distances and may be troublesome several miles inland.

The following table gives the status of the salt marsh areas of Connecticut, and while not complete, gives all available information. The first column names towns which contain salt marsh areas; the second gives the total amount of salt marsh in acres; the third, the acres ditched; the fourth, the number of acres maintained by the State; the fifth, the amount previously expended for ditching; the sixth, the cost of labor expended in maintenance work in accepted areas of each town in 1926; and the last column is an estimate of what it would cost to complete the ditching. In most cases this estimate is high and must not be accepted as a final estimate. Figures given under each column represent a total for the State.

STATUS OF CONNECTICUT SALT MARSH AREAS, 1926

Town	Salt Marsh Areas	Salt Marsh Ditched	Maintained by State	Total Cost of Ditching	Labor, Cost of Maintenance, 1926	Labor, Cost to Complete Ditching
Greenwich	200	200	None	.....	.....	.....
Stamford	300	300	200	$3,245.80	$175.00	.....
Darien	300	300	None	3,800.00	.....	.....
Norwalk	600	600	None	7,500.00	.....	.....
Westport	400	300	None	2,514.29	.....	$1,500.00
Fairfield	1,200	1,200	1,200	8,400.00	857.00	.....
Bridgeport	173	....	....	.....	.....	3,000.00
Stratford	1,315	....	....	.....	.....	20,000.00
Milford	630	....	....	.....	.....	9,500.00
West Haven	463	222	222	Ditched with New Haven	255.25	3,500.00
New Haven	750	750	675	12,000.00	573.94	750.00
Hamden, No. Haven, East Haven	2,042	....	....	.....	.....	30,000.00
	482	150	50	Ditched with New Haven	59.00	6,500.00
Branford	895	578	578	.....	878.76	4,800.00
Guilford	1,085	1,085	1,085	20,000.00	1,961.35	.....
Madison	1,005	1,005	1,005	.....	1,743.41	.....
Clinton	785	677	None	10,000.00	.....	2,000.00
Westbrook	500	220	None	3,354.62	.....	3,500.00
Old Saybrook	1,373	100	None	.....	.....	20,000.00
Lyme	493	....	....	.....	.....	7,500.00
Old Lyme	1,393	....	....	.....	.....	21,000.00
East Lyme	424	....	....	.....	.....	6,500.00
Waterford	204	....	....	.....	.....	3,500.00
New London	34	....	....	.....	.....	500.00
Groton	304	50	50	1,000.00	40.07	4,000.00
Stonington	555	....	....	.....	.....	8,500.00
	18.005	7,737	5,065	$71,814.71	$6,553.78	$156,550.00

THE WORK BY TOWNS

NEW HAVEN

The areas under State maintenance in the towns of New Haven, East Haven, Branford, and Guilford were treated as one unit this season. Two men, with Mr. C. F. Johnson as foreman, patrolled these areas and recut and deepened thousands of feet of 10" x 24" ditches. This crew also covered the Groton area and did some work in Madison and West Haven.

At the request of the Chamber of Commerce of New Haven, a report of mosquito breeding conditions in and around New Haven was furnished by this Station, as follows:

REPORT ON ELIMINATION OF MOSQUITOES IN THE NEW HAVEN DISTRICT, JULY 20, 1926

A—*Salt Marsh Mosquitoes.*

The Salt Marsh or Migratory Mosquito breeds in stagnant, brackish water, bites both day and night, and flies several miles

from breeding places. The control is simple and effective—draining the salt marshes.

Some years ago, as a result of local interest, funds were raised sufficient to drain most of the marshes in New Haven and West Haven, some areas in East Haven, and the eastern part of Branford.

The areas in and near New Haven remaining undrained and probably furnishing New Haven with mosquitoes are as follows:

New Haven	75	acres
North Haven	310	"
Hamden	571	"
East Haven	495	"
Branford	317	"
	1,768	"

The Estimated Costs:

New Haven		
	Ditching	$ 750
	Tide gate at Middletown Avenue	2,000
	Dredging Morris Creek	3,000
		$5,750
North Haven		
	Ditching	$3,100
Hamden		
	Ditching	$5,700
East Haven		
	Ditching	$5,000
Branford		
	Ditching	$3,200

For the relief of New Haven, three projects should be undertaken at once (see figure 10).

Project No. 1.	Ditching in Hamden	571 acres, cost	$5,700.
	Ditching in New Haven	75 acres, cost	750.
	Ditching in North Haven	310 acres, cost	3,100.

Tide gates on Little River at Middletown Avenue will make effective the ditching of 252 acres in New Haven and North Haven.

Project No. 2. Ditching in East Haven 495 acres, cost $5,000.

Dredging of Morris Creek will make effective the ditching of 75 acres in New Haven and about the same amount in East Haven.

Project No. 3. Ditching in Branford 317 acres, cost $3,200.

B—*Fresh Water Mosquitoes.*

This is a problem that can only be attacked by local agencies. In the towns of Fairfield and Stamford the Health Officer employs

a deputy who spends a day or two a week on mosquito work. This man inspects the whole town and either removes or causes to be removed standing water that may breed mosquitoes. There is nothing that will so quickly raise the sanitary standards of a town as an efficient, permanent policy of mosquito elimination.

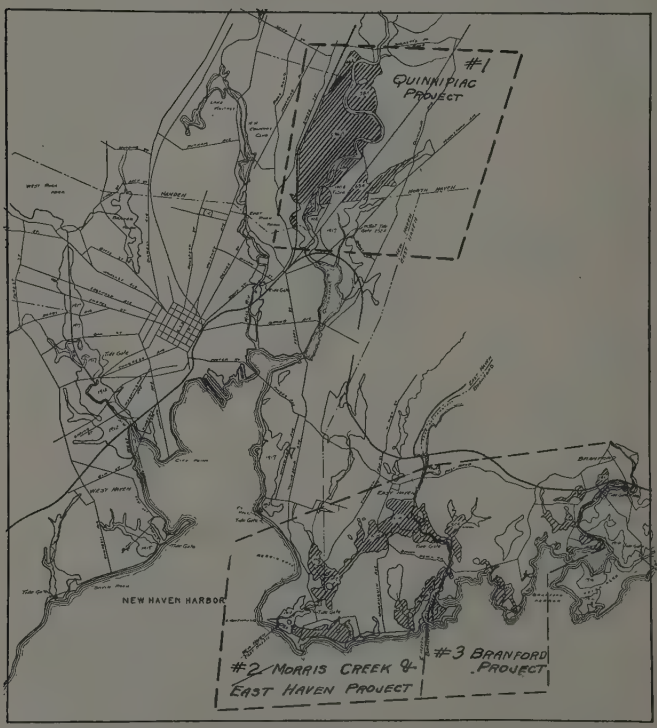

FIG. 10. Map of New Haven and vicinity; marsh areas enclosed by dotted lines need further ditching to eliminate mosquito breeding.

WEST HAVEN

The maintenance work was carried on under the same plan as in 1925, with Dr. Phelps in entire charge of the work. The town of West Haven furnished $1,000 and this Station added $220, which is the maximum amount available for the town under the present State appropriation. Not only were the areas under State care at Old Field Creek and West River kept from breeding,

but all other salt marsh breeding areas and some fresh water breeding places were eliminated by ditching. State funds alone are inadequate to properly maintain some of the West Haven areas in their present condition. The results of this season's work were reported to be highly satisfactory, and the amount actually expended was $787.75.

EAST HAVEN

About one-tenth of the salt marsh area of East Haven is under State care. This comprises two small areas, one extending from Morris Creek eastward to the road to Shell Beach, and the other the area from Momauguin westward to Caroline Creek. Ditches on these areas were cleaned and recut where necessary and mosquito breeding eliminated on these areas. The remaining salt marsh areas of the town have never been adequately ditched for mosquito elimination to be acceptable for State maintenance and are the source of the greatest mosquito nuisance.

Mosquitoes which breed in rain barrels and fresh-water swamps were much in evidence.

The new tide gates installed by the town on the East Haven River tend to restrict mosquito breeding on the large marsh east of Hemingway Avenue.

BRANFORD

The dike at Stony Creek was repaired satisfactorily but the marsh above, being flooded for several years, requires reditching. Tide gates at Hubbard's Bridge on the Branford River were patched and coaxed to last through the season, but must be rebuilt this year. No funds are available for this work. The salt marshes west of the Branford River do not come under State care.

GUILFORD

A campaign of recutting and grading ditches, which was begun in September, 1925, was continued this season, with the result that now more than three-fourths of the total footage of ditches is in perfect condition. It has been brought to the attention of this Station that some of the recut ditches have been filled for crossings and left so. This is contrary to law and we urge that this practice be discontinued immediately. The dike at Great Harbor was damaged by storms this winter.

MADISON

Patrolling of beach outlets, marshes, and recutting of ditches was continued as usual this season, with the result that little mosquito breeding occurred in this town.

The State Park and Forest Commission voted $1,000 for anti-mosquito work in the State parks. This was used at Hammonasset for reditching a large breeding area near the Hammonasset River which was formerly flooding the park with mosquitoes periodically, and also for overhauling the ditches west of the pavilion toward Webster Point.

CLINTON

On June 1, 1926, the town of Clinton entered into contract with Mr. Edwin M. Skinner of Bloomfield, N. J., to ditch five-sixths of the salt marshes of the town under State supervision. Funds were not sufficient to complete the whole area at this time.

Legal notices were sent to all record marsh owners and every effort was made to cause as little inconvenience as possible to the marsh owners and yet obtain the desired results. Ditches were placed on boundaries wherever possible and intermediate ditches placed where necessary. The work of ditching will be completed before the next mosquito breeding season, and the maintenance work will start just as soon as the funds, which have been requested, are received.

WESTBROOK

The town of Westbrook appropriated $3,500 to complete the ditching of the salt marshes of the town. This work is being done under State supervision and will be completed next season. Funds for maintenance during the following biennium have been requested according to statute.

GROTON

Some new ditches were installed in this area to improve drainage, and the old ditches were cleaned and graded where necessary to prevent possible mosquito breeding.

FAIRFIELD

Where possible, salt marshes were burned over to facilitate the patrol work and cleaning. Altogether, 17,832 feet of new 10" x 24" ditches were cut to improve drainage, and 35,942 feet of old ditches recut and graded. The town of Fairfield continued its fresh water work and installed nearly 800 feet of pipe drains. Swamps which could not be drained were oiled every ten days and 100 gallons of crank case oil at four cents a gallon were used.

The funds available for work in Fairfield this season were as follows:

Appropriations, Town	$3,301.15
" State	857.00
Fairfield Improvement Association, Inc.	146.05
DuPont Fabricoid Company	250.00
Mr. and Mrs. M. Neary	125.00
Total	$4,679.20

Mosquito control work was reported very successful this season, and at the town meeting on October 5 it was unanimously voted to appropriate $3,000 for the season of 1927.

WESTPORT

Funds sufficient to ditch all salt marshes in the town of Westport were made available, and the Connecticut Agricultural Experiment Station was requested to supervise the work. Ditching was started on October 15, 1926, and continued until about December 1, when a heavy fall of snow prevented further work. The work will be completed next season, and State maintenance will start when funds are made available. This ditching job so far has progressed very satisfactorily, due to the co-operation of the property owners.

STAMFORD

The salt marshes were burned over early in the spring wherever possible. About 9,873 feet of new 10" x 24" ditches were cut and 21,636 feet of old ditches recut and graded. About fifty feet of drain pipes were installed and 450 gallons of oil used to spray mosquito breeding pools which could not be drained.

This work was done by experienced men from Fairfield, and funds were furnished as follows:

Appropriation, City of Stamford	$210.35
" State	175.00
Shippan Point Association	550.00
Scofield Estate	48.50
	$983.85

Treatment of fresh water swamps was continued as usual by the City of Stamford.

MISCELLANEOUS INSECT NOTES

Leaf Roller on Hickory: Leaf rollers on hickory were collected near the Station and brought to the laboratory June 16. On June 23, an adult moth emerged and proved to be *Archips rosana* Linn. In 1913, this insect was rather abundant on certain privet hedges in New Haven, rolling the leaves of the terminal shoots. It was also observed in 1915.

Dingy Cutworm Injuring Apple Trees: On May 14, 1926, Mr. Zappe collected at Wallingford some cutworms which had eaten the buds from grafts in small apple trees which had been planted in the orchard two or three years. The owner top-worked these trees and in most cases the injured grafts were not more than three feet from the ground. In September, some adults emerged and were identified as the moths of the dingy cutworm, *Feltia subgothica* Haworth.

Spruce Scale: Specimens of the spruce scale, *Physokermes piceae* Schrank, were received from Woodlawn, N. Y., February 9, 1926. These insects are globular and are usually clustered in groups surrounding the bases of the twigs and resembling buds. They are rigid, from 1.5-3 mm. in diameter, and chestnut-brown in color. This species has been recorded from Connecticut.

Beets Attacked by Greenhouse Leaf-Tyer: On September 23, 1925, Mr. E. M. Stoddard of the Botany Department brought to the laboratory some Lepidopterous larvae which he found feeding upon the leaves of beets in his garden in Hamden. On March 1, 1926, one adult emerged, and proved to be the greenhouse leaf-tyer, *Phlyctaenia ferrugalis* Hubn. This insect has often caused injury to various plants under glass and outside. Spraying with lead arsenate may be practiced with success where the foliage is not to be used for human food.

European Grain Beetle in Connecticut: The European grain beetle, *Cathartus advena* Waltl. occurs in Connecticut and two specimens are now in the Station collection. One of them was collected in Fairfield, May 10, 1921, by M. P. Zappe, and the other in Cornwall, November 29, 1922, by K. F. Chamberlain. The former specimen was identified by Mr. H. C. Fall. This species often attacks stored grain and other plant products, especially where decay has set in. It is also found under the bark of dead trees. It belongs to the family Cucujidae.

Japanese Scale Insect: In the Report of this Station for 1915, page 139, is a record of the occurrence in Connecticut of a Japanese scale, *Leucaspis japonica* Cockerell, which had been collected on silver and Norway maple and privet in Greenwich. On December 14, this insect was again received from Greenwich on

silver and Norway maples; it is said to have caused considerable injury in that section of the town known as Belle Haven. Some of the infested trees have been sprayed each year for the past two years with a miscible oil (1-15) which considerably reduced the infestation, but it was not completely effective because in late fall there was a moderate number of living scales on the trees. Further field tests must be made for the control of this insect before we shall be in a position to make recommendations concerning treatment.

Flight of Cotton Moth: For a period of two or three weeks in late September and early October, there were moderate numbers of the cotton moth, *Alabama argillacea* Hubn. resting on the store windows along Chapel Street in New Haven, and Mr. J. L. Rogers observed similar conditions in Bridgeport. On October 8, eight specimens of this moth were received from Waterbury. The invasion seems to have been rather general. Similar flights of moths varying in abundance have been recorded in the Reports of this Station for 1911, page 339; 1912, page 217; 1919, page 202; and 1923, page 313. The larvae of this moth are known to feed only on cotton, and the moths must have migrated from the southern states where cotton is grown. It is believed that the species does not winter anywhere in the United States, but comes in each year from the West Indies, Mexico, or other southern countries.

Persimmon Psyllid in Connecticut: On July 17, some insects were received from Dr. Robert T. Morris, Stamford, on persimmon twigs. The leaves were curled at the edges, and the immature psyllids lived under the curled margins. One adult developed and proved to be the persimmon psyllid, *Trioza diospyri* Ashm., a species common on persimmon trees in the South, though not before recorded as occurring in Connecticut. Dr. Morris regards this insect as a destructive pest of cultivated Japanese, American, and hybrid persimmons, and states that the native persimmon is not often attacked. He further states that either the adults or young attack and destroy the terminal buds. Though his cultivated varieties have received several sprayings with tobacco and the infestation has been reduced somewhat, the insect is still sufficiently destructive to halt the growth on many branches. Probably the best chance of control lies in an application of nicotine sulphate solution and soap soon after the eggs hatch and before the leaves are curled.

European Pine Shoot Moth: The presence of this insect at Ridgefield was recorded in the Report of this Station for 1923, page 311, and for a longer period the pest has been known to be present on Long Island and in Westchester County, New York, adjoining Connecticut. This insect has been cited in literature

under the name of *Evetria buoliana,* but is now known as *Rhyacionia buoliana* Schiff. In 1925, Messrs. Filley and Zappe observed the characteristic crooked growth or "bayonet shoots" on red or Norway pines growing in Greenwich and also in the plantations of the Bridgeport Hydraulic Company along the highway between Bridgeport and Danbury, probably in the town of Easton. The entomologist visited these areas in company with Mr. Filley, on July 26. Although they saw some of the crooked growth, caused by the larvae killing the buds of the leaders, they were pleasantly surprised to see how readily the red pine adapts itself and recovers from such injuries. In several cases where all buds in a cluster had been killed, adventitious buds had formed, and one of these, if not injured, would replace the leader with almost no deformation. Further observations will be made regarding the injuries caused by this insect.

Silky Robber Fly: In making a small vegetable garden on an open hillside at Mount Carmel during May, the writer observed dozens of white larvae in the soil. These were evidently Dip-

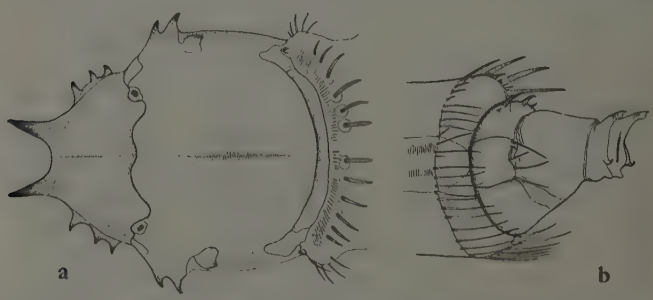

FIG. 11. Pupa of the silky robber fly, *Asilus sericeus* Say. a, dorsal view of head and thorax; enlarged about eight times. b, lateral view of posterior extremity; enlarged about fifteen times.

terous larvae and were nearly an inch in length and of nearly uniform thickness, though tapering slightly, and bluntly pointed at both ends. A row of stiff bristles or spines pointed backward on the dorsum of each segment. Material was gathered and placed in the insectary. In a day or two some of these larvae transformed to golden brown pupae which were much smaller than the larvae. Though the larvae were nearly an inch in length, the pupae were between half and five-eighths of an inch. On the head are borne two rather prominent teeth with a three-toothed lateral projection and the front and lateral margins of the thorax

are peculiarly toothed and scalloped, as shown in figure 11. The pupa has been described in detail by Malloch.[1] On May 29, four adults emerged and proved to be the silky robber fly, *Asilus sericeus* Say, a species with head, thorax, and body together totaling about an inch in length. The general color is golden brown, with darker brown eyes, median stripe on thorax and bases of abdominal segments. The wings are of the same color, with darker marginal cells. The legs are golden brown with darker femora; under surface, legs golden brown with dark brown thorax and abdomen. Larva, pupa and adult are shown on plate XVI. Apparently little is known regarding the larval habits of the silky robber fly. Malloch states that "the habits of the larvae are unknown to me."[2] He also states that "*Asilus notatus* and *Leptogaster flavipes* I have found only in or near woods, and especially in or under decaying wood, and it is very probable that they confine themselves to attacks upon species that are found in such situations—Tenebrionidae and Cerambycidae particularly."[3]

All Asilid larvae are supposedly predaceous, feeding upon other insect larvae. Williston states that "young larvae sometimes bore their way completely within the bodies of other larvae, remaining there till their food is wholly consumed. Often the larvae are found free in the earth, however, where their transformations occur. The eggs are laid about grass stems, or in crevices of decaying logs and trees infested by the larvae of other insects."[4]

Mr. E. L. Bell has recorded his observations on the adult of this fly as a captor of butterflies on the wing. In one case the common pearl crescent, *Phyciodes tharos* Drury, was captured.[5] In another instance the victim was the silver-spotted skipper, *Epargyreus tityrus* Fabr.[6]

[1] Bull. Ill. State Lab. Nat. Hist., Vol. xii, page 386, 1917.
[2] *Ibid.*, page 387.
[3] *Ibid.*, page 374.
[4] Manual of N. A Diptera (3d ed.), page 196, 1908
[5] Bull. Brook. Ent. Soc., Vol. xvi, page 96, 1921.
[6] Jour. N. Y. Ent. Soc., Vol. xxxii, page 219, 1924.

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a. General view of gipsy moth infestation discovered in East Port Chester, Greenwich.

b. Close-up view of tree shown above, with stone of wall upturned to show egg-clusters.

GIPSY MOTH.

a. View showing sprayed trees in Greenwich infestation.

b. View of "dump" near Greenwich infestation.

GIPSY MOTH.

a. Overwintering females of *Adelges abietis* Linn.; left, appearance of females during winter, enlarged ten times; right, appearance of females at time of oviposition, enlarged four times; center, waxy threads removed to show eggs, enlarged four times.

b. Partially developed galls of *Adelges abietis* Linn., on Norway spruce, natural size.

SPRUCE GALL APHIDS.

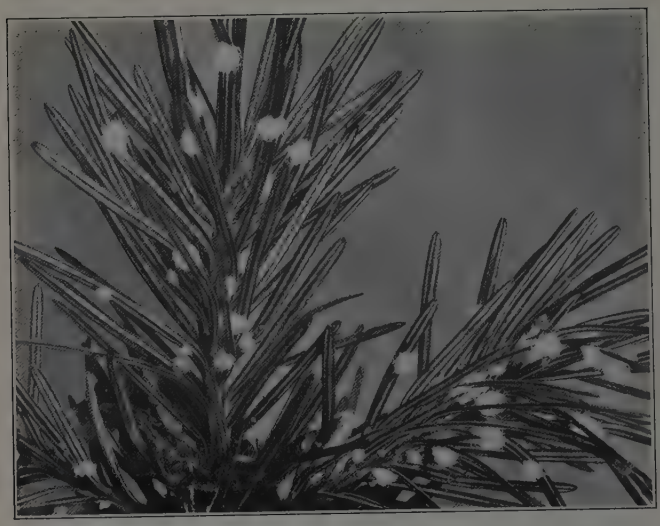
PLATE IV.

Galls of *Adelges abietis* Linn. on twigs of Norway spruce, natural size.

SPRUCE GALL APHIDS.

Young Norway spruce covered with galls of *Adelges abietis* Linn.

SPRUCE GALL APHIDS.



a. *Gillettea cooleyi* var. *coweni* Gillette, on Douglas fir, twice enlarged.

b. Galls of *Gillettea cooleyi* Gillette, on blue spruce, natural size.

SPRUCE GALL APHIDS.

a. View of barn rented as headquarters, 132 West Elm Street; end of insectary may be seen in the rear at left.

b. Insectary built for life history studies, at 132 West Elm Street.

a. View in nursery where men are making diggings in search for grubs; none were found here.

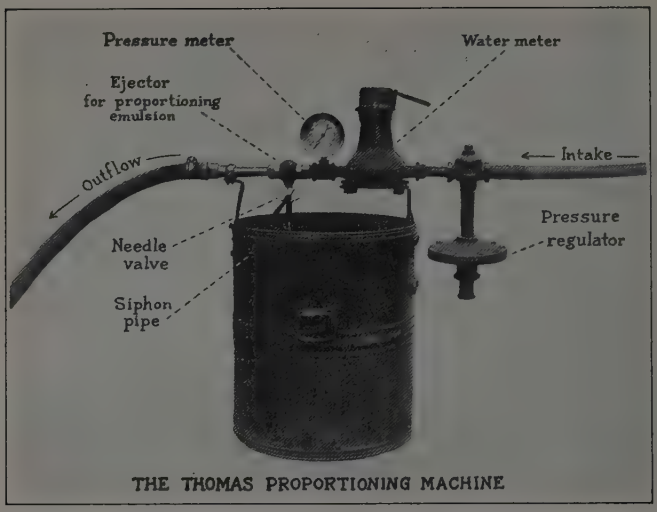
b. Making a digging in a lawn.

ASIATIC BEETLE WORK.

a. Lawn on McKinley Avenue, showing injury by grubs.

b. Lawn on Edgewood Avenue showing spots injured by grubs.

ASIATIC BEETLE WORK.



a. View of Thomas Proportioning Machine.

b. Nozzle discharging emulsion upon a lawn.

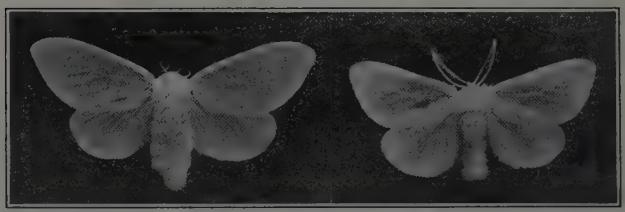
ASIATIC BEETLE WORK.

a. Method of applying emulsion to lawns.

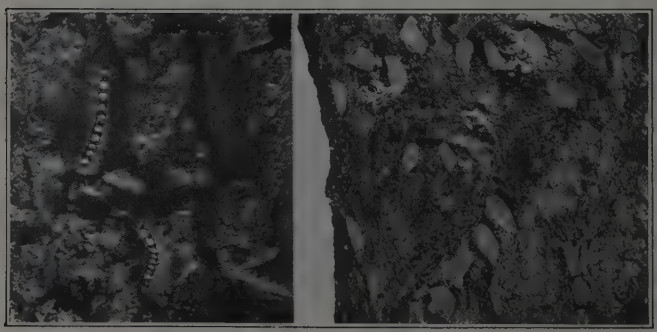
b. Method of treating flower beds.

ASIATIC BEETLE WORK.

a. Method of treating soil around roots of trees to kill grubs of Asiatic beetle.



b. Female and male satin moths, natural size (After Burgess and Crossman, Dept. Bull. 1469 U. S. Dept. of Agriculture).



c. (Left) Caterpillars, and (right) winter cases of satin moth (After Burgess and Crossman, Dept. Bull. 1469, U. S. Dept. of Agriculture).

ASIATIC BEETLE WORK AND SATIN MOTH.

a. Japanese beetle, *Popillia japonica* Newm.; adults twice enlarged.

b. Apples injured by Japanese beetles (After Jap. Beetle Lab. U. S. Dept. of Agriculture).

c. Japanese beetles clustered on fruit (After Jap. Beetle Lab., U. S. Dept. of Agriculture).

JAPANESE BEETLE.

a. Rose leaves eaten by Japanese beetles, natural size.

b. View in a Stamford back yard where Japanese beetles were found.

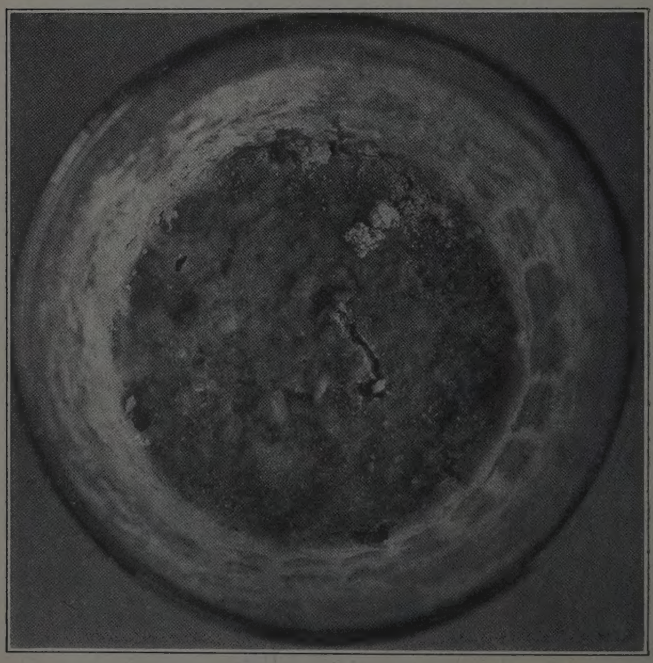
JAPANESE BEETLE.

a. Dike at Leetes Island, Guilford, damaged by storms.

b. Cleaning ditches, New Haven.

MOSQUITO CONTROL WORK.

a. Silky robber fly, *Asilus sericeus* Say. Adult at left, larva at right, pupa case in center, all twice enlarged.



b. Artificial mixture showing tunnel just beneath the surface, and piles of frass like those found on fruits, where larvae of Oriental peach moth have entered.

SILKY ROBBER FLY AND ORIENTAL PEACH MOTH.